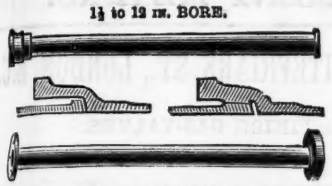
THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LVIII. No. 1488.] LONDON, NOVEMBER 17, 1891. [43RD YEAR. Price 6d.

GAS AND WATER PIPES.

1¼ to 12 IN. BORE.



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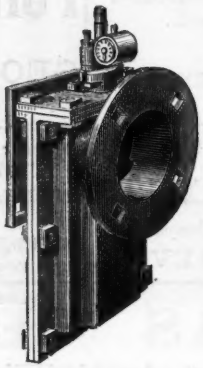

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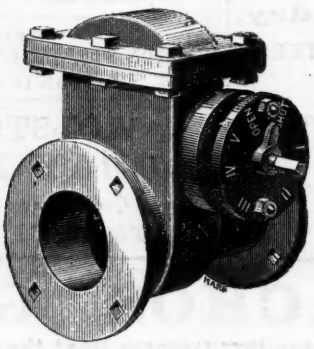

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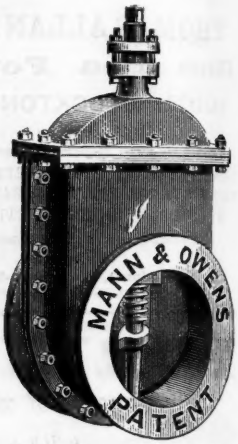

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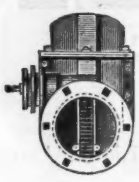

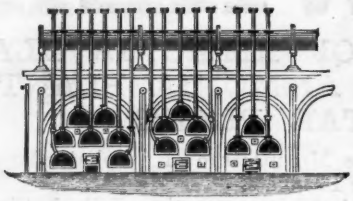

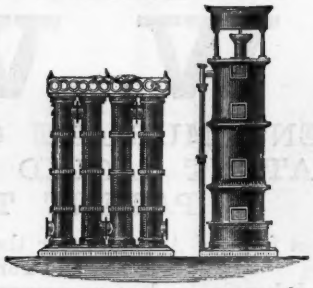

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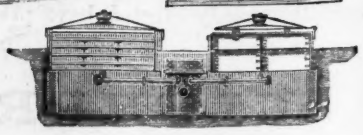

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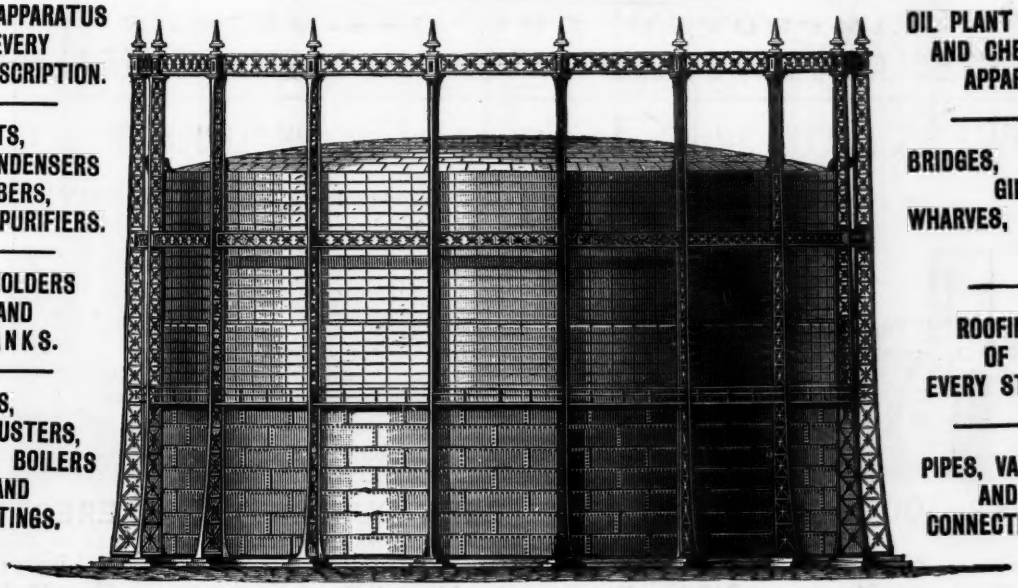

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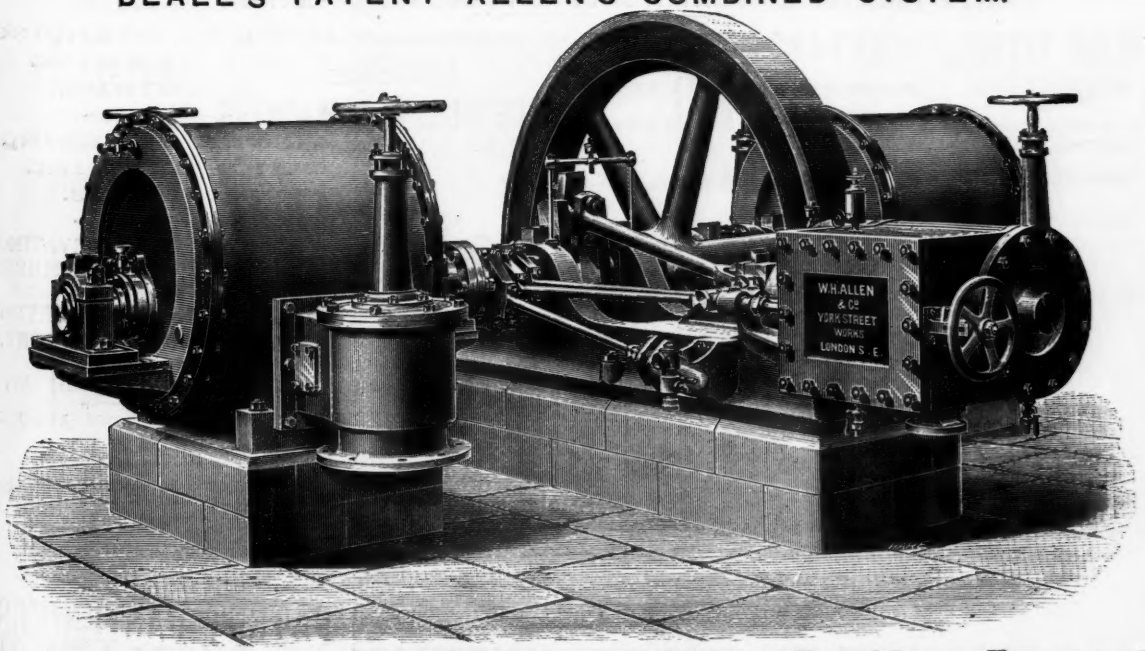

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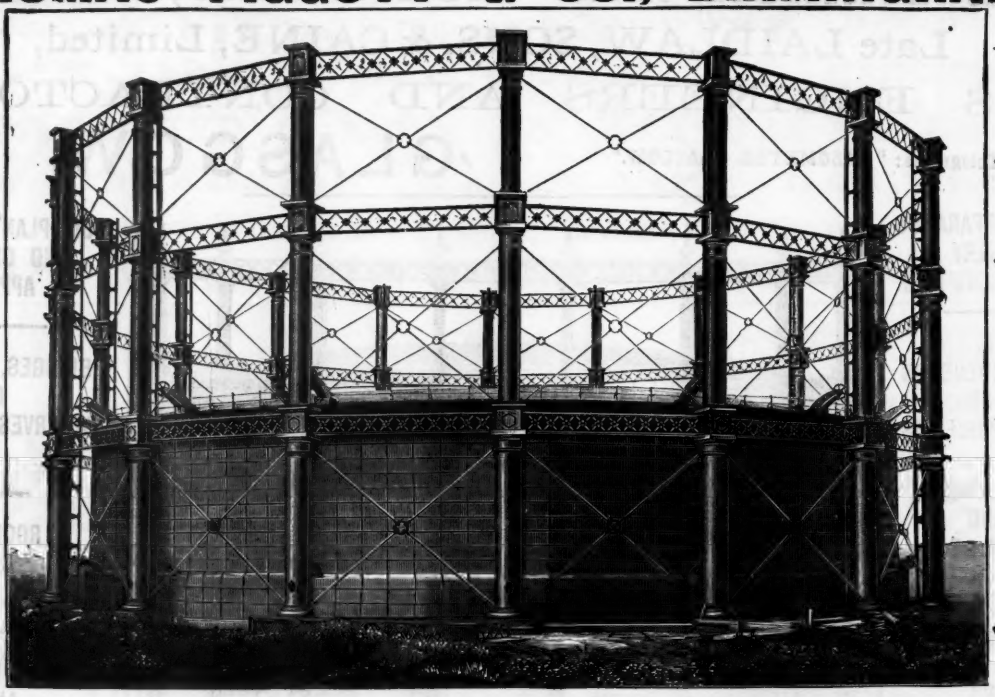

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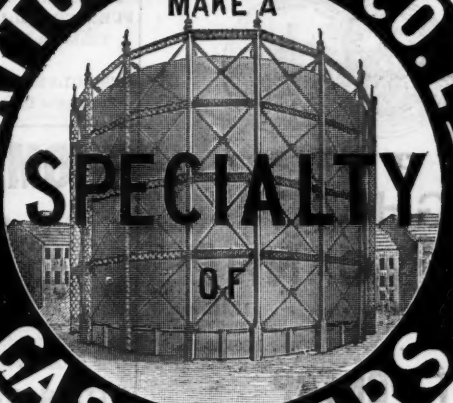

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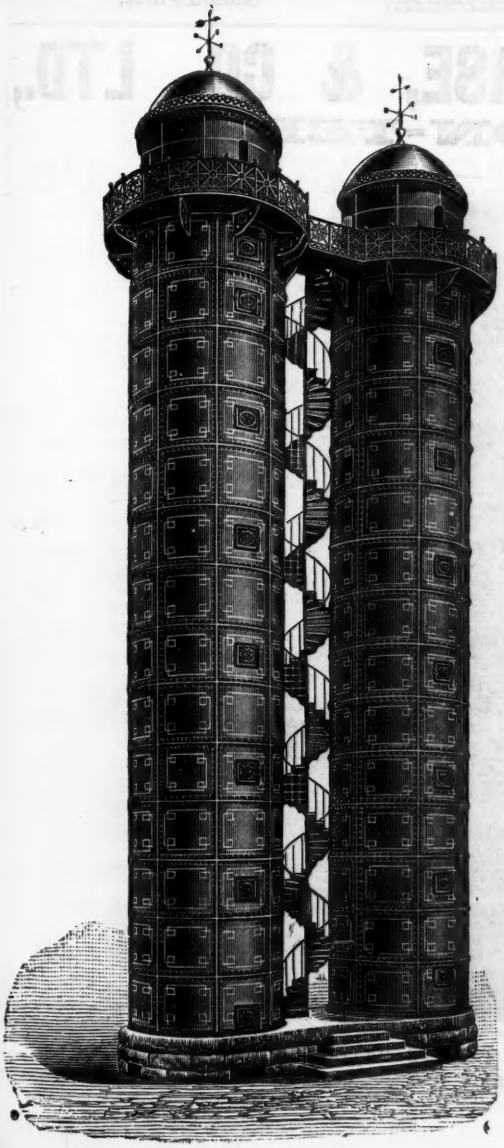

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Messrs. R. & J. D. wish to specially direct the attention of Gas Managers to the larger quantity of Ammoniacal Liquor or Sulphate **made** by their Scrubbers than by any of the numerous Rotary and other Machines now upon the market. From 28 lbs. to 34 lbs. of Sulphate are produced (per ton of coal carbonized) by their Scrubbers; whereas 20 lbs. to 22 lbs. is as much as can be got by the Machines. Gas Managers with low yields of Sulphate should not rest satisfied (because Ammonia does not show on test papers) until they are getting all the Ammonia it is possible to make. It should be remembered that each gallon of liquor, or 1 lb. of Sulphate, is worth about 1d.; thus, when every ton of coal carbonized is multiplied by 6d., 8d., 10d., or 1s., from increased yield of Sulphate on the quantity of coals used per annum, a very large extra profit is made. Irrespective of the profit made from the increased yield of Ammonia, these Scrubbers utilize the Ammonia as a purifying agent, and very considerably reduce the amount of work to be done in the purifiers.

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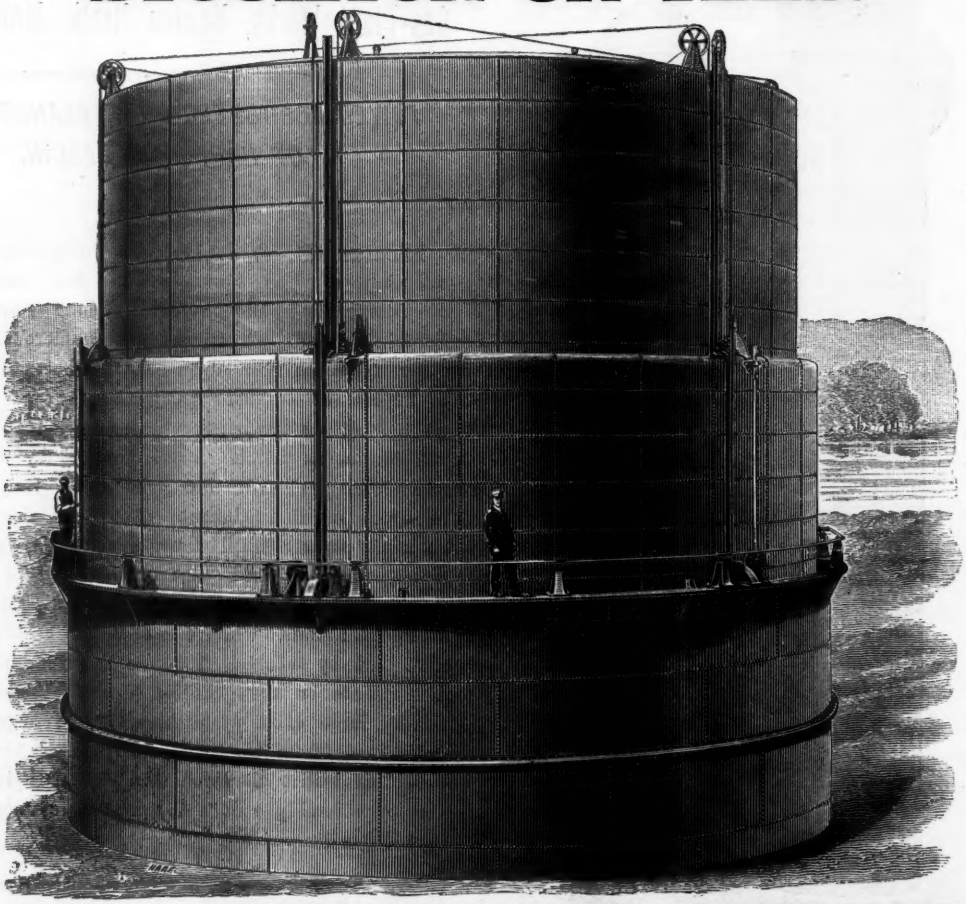

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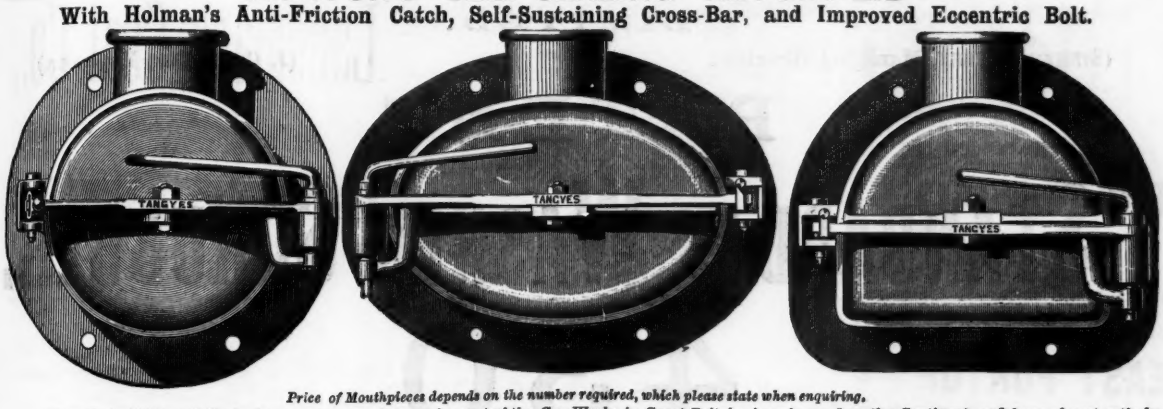

Price of Mouthpieces depends on the number required, which please state when enquiring.

These Retort Lids and Fastenings are in extensive use in most of the Gas-Works in Great Britain, America, and on the Continent, and have almost entirely displaced the older method of sealing by a luting of lime or other material. The Lids are made in three forms, round, oval, and D (as shown above), in each of which we have a very extensive variety of patterns, from which Gas Engineers contemplating the adoption of these lids are recommended to make their selection, in order to avoid cost of pattern making, delays, &c., &c.

Mouthpieces with Circular Lids for Round Retorts.

Pattern No.	Diam. Mouth.	Internal Dimensions of Retort.	Length of Mouthpiece.	Lid and Fittings without Mouthpiece.
3494	14 ins.	14 ins.	12½ ins.	£0 19 0
2982	15 ,,	15 ,,	14 ,,	1 0 0
3453	15 ,,	15 ,,	12½ ,,	1 0 0
3497	15 ,,	15 ,,	15 ,,	1 0 0
3630	16 ,,	16 ,,	10½ or 11⅝ ,,	1 1 0
4549	16 ,,	16 ,,	15½ ,,	1 1 0
6262	16 ,,	16 ,,	13½ ,,	1 1 0
6396	16 ,,	16 ,,	15 ,,	1 1 0
7668	16 ,,	16 ,,	17⅝ ,,	1 1 0
10289	16 ,,	16 ,,	11 ,,	1 1 0
3356	17 ,,	17 ,,	15 ,,	1 3 0
7125	17 ,,	17 ,,	6 ,,	1 3 0
933	18 ,,	18 ,,	11⅝ ,,	1 5 0
4045	18 ,,	18 ,,	14 ,,	1 5 0
6397	18 ,,	18 ,,	15 ,,	1 5 0
8013	18 ,,	18 ,,	15 ,,	1 5 0

Taper Circular Mouthpieces with Circular Lids for Round Retorts.

Pattern No.	Front.	Back.			
13001	15 to 21 ins.		21 ins. diam.	18½ ins.	£1 0 0
13261	15 ,, 24 ,,		15 ,,	13½ ,,	1 0 0
12995	15 ,, 30 ,,		30 ,,	18 ,,	1 0 0
9562	18 ,, 21 ,,		21 ,,	12½ ,,	1 5 0
10425	18 ,, 21 ,,		21 ,,	4½ ,,	1 5 0
13418	18 ,, 22 ,,		22 ,,	12 ,,	1 5 0
13396	20 ,, 20⅝ ,,		20⅝ ,,	4 ,,	1 11 0

Mouthpieces with Circular Lids for D Retorts.

Pattern No.	Diam. Mouth.	Internal Dimensions of Retort.	Length of Mouthpiece.	Lid and Fittings without Mouthpiece.
5348	14 ins.	14 × 13 ins.	7 ins.	£0 19 0
14209	14 ,,	14 ,, 13 ,,	13½ ,,	0 19 0
14231	14 ,,	12⅝ ,, 12⅝ ,,	10 ,,	0 19 0
3463	15 ,,	15 ,, 13 ,,	14 ,,	1 0 0
6678	15 ,,	15 ,, 14 ,,	12 ,,	1 0 0
3661	15½ ,,	15½ ,, 13 ,,	12 ,,	1 1 0
13052	16 ,,	16 ,, 13 ,,	18 ,,	1 1 0
5601	16 ,,	16 ,, 14 ,,	15 ,,	1 1 0
6827	16 ,,	16 ,, 14 ,,	17 ,,	1 1 0
4494	16 ,,	16 ,, 14 ,,	14 ,,	1 1 0
3548	16 ,,	16 ,, 15 ,,	12½ ,,	1 1 0
6677	16 ,,	16½ ,, 13½ ,,	12½ ,,	1 1 0
9645	16 ,,	16½ ,, 13½ ,,	12½ ,,	1 1 0
4434	16 ,,	17½ ,, 14 ,,	14 ,,	1 1 0
6469	16 ,,	18 ,, 14 ,,	15 ,,	1 1 0
9015	16 ,,	18 ,, 14 ,,	16½ ,,	1 1 0
4327	16 ,,	18 ,, 15 ,,	15½ or 19 ,,	1 1 0
8049A	16 ,,	18 ,, 15 ,,	17⅝ ,,	1 1 0
6137	16 ,,	20⅝ ,, 13½ ,,	10½ ,,	1 1 0
5918	17 ,,	18 ,, 14 ,,	14 or 17 ,,	1 3 0
5053	17 ,,	19⅝ ,, 12 ,,	14½ ,,	1 3 0
7548	17 ,,	20 ,, 13 ,,	15 ,,	1 3 0
6468	17 ,,	20 ,, 16 ,,	15½ ,,	1 3 0
4316B	17 ,,	21 ,, 14 ,,	14 ,,	1 3 0
7975	17 ,,	21 ,, 15 ,,	14½ ,,	1 3 0
13459	17 ,,	21½ ,, 13½ ,,	15 ,,	1 3 0
14284	18 ,,	18 ,, 13½ ,,	19 ,,	1 5 0
12990	18 ,,	18 ,, 15 ,,	15 or 19 ,,	1 5 0
7135	18 ,,	18⅝ ,, 15 ,,	13 ,,	1 5 0
10221	18 ,,	18 ,, 16 ,,	19⅝ ,,	1 5 0
4506	18 ,,	20 ,, 13 ,,	19½ ,,	1 5 0
6470	18 ,,	20 ,, 13 ,,	15 ,,	1 5 0
6818	18 ,,	20 ,, 13½ ,,	17½ ,,	1 5 0
13998	18 ,,	20 ,, 14 ,,	19½ ,,	1 5 0
4083	18 ,,	20 ,, 15 ,,	16 ,,	1 5 0
5306	18 ,,	20½ ,, 14 ,,	13½ ,,	1 5 0
13295	18 ,,	20½ ,, 14 ,,	19½ ,,	1 5 0
7356	18 ,,	20⅝ ,, 13½ ,,	13 ,,	1 5 0
4569	18 ,,	21 ,, 14 ,,	18 ,,	1 5 0
3628	18 ,,	21 ,, 15 ,,	16 ,,	1 5 0
13999	18 ,,	22 ,, 14 ,,	19½ ,,	1 5 0
7640	18 ,,	22 ,, 13½ ,,	13½ ,,	1 5 0
14250	19 ,,	19 ,, 14 ,,	19 ,,	1 8 6
14286	19 ,,	20 ,, 13½ ,,	20 ,,	1 8 6
7971A	20 ,,	20 ,, 15 ,,	18 ,,	1 11 0
14285	20 ,,	21 ,, 13½ ,,	19 ,,	1 11 0

Mouthpieces with Circular Lids for Oval Retorts.

Pattern No.	Diam. Mouth.	Internal Dimensions of Retort.	Length of Mouthpiece.	Lid and Fittings without Mouthpiece.
13658	14 ins.	14 × 12 ins.	15 ins.	£0 19 0
4356	14 ,,	18½ ,, 12 ,,	13½ ,,	0 19 0
6851	15 ,,	16 ,, 14 ,,	13 ,,	1 0 0
3629	15 ,,	18½ ,, 13½ ,,	14 ,,	1 0 0
3580	15 ,,	21 ,, 15 ,,	15 ,,	1 0 0
6264	16 ,,	18½ ,, 15½ ,,	15½ ,,	1 1 0
5210	16 ,,	20 ,, 14 ,,	15 ,,	1 1 0
6263	16 ,,	24 ,, 16 ,,	13½ ,,	1 1 0
5370	17 ,,	20 ,, 14 ,,	14 ,,	1 3 0
6832	17 ,,	20 ,, 14 ,,	17 ,,	1 3 0
6183	17 ,,	20 ,, 15 ,,	15 ,,	1 3 0
4289	17 ,,	21 ,, 15 ,,	14 ,,	1 3 0
5270	17 ,,	22 ,, 14 ,,	14 ,,	1 3 0
3631	18 ,,	18 ,, 14 ,,	20 ,,	1 5 0
3681	18 ,,	21 ,, 14 ,,	13½ or 15 ,,	1 5 0
3554	18 ,,	21 ,, 15 ,,	14¾ ,,	1 5 0
7957	18 ,,	22 ,, 16 ,,	14 ,,	1 5 0
8048A	19 ,,	25½ ,, 15 ,,	18 ,,	1 8 6

Mouthpieces with Oval Lids for Oval Retorts.

Pattern No.	Dimensions of Mouth.	Internal Dimensions of Retort.	Length of Mouthpiece.	Lid and Fittings without Mouthpiece.
9800	18 × 14⅞ ins.	18 × 14⅞ ins.	15 ins.	£1 5 0
9205	20 ,, 12 ,,	24 ,, 14 ,,	10½ ,,	1 10 0
10000	20½ ,, 14½ ,,	20½ ,, 14½ ,,	16 ,,	1 10 0
9680	21 ,, 15 ,,	21 ,, 15 ,,	15 ,,	1 12 0
10056	21 ,, 14½ ,,	21 ,, 14½ ,,	15¾ ,,	1 12 0
13218	21 ,, 15 ,,	21 ,, 15 ,,	17 ,,	1 12 0
10514	22½ ,, 13⅝ ,,	22½ ,, 13⅝ ,,	13⅝ ,,	1 13 0
13766	20 ,, 17 ,,	20 ,, 17 ,,	15½ ,,	1 15 0
13269	24 ,, 15 ,,	24 ,, 15 ,,	16 ,,	1 18 0
13884	24 ,, 15 ,,	24 ,, 15 ,,	10 ,,	1 18 0

Mouthpieces with D Lids for D Retorts.

Pattern No.	Dimensions of Mouth.	Internal Dimension of Retort.	Length of Mouthpiece.	Lid and Fittings without Mouthpiece.
12292	15½ × 13 ins.	15½ × 13 ins.	12 ins.	£1 2 0
9987	16 ,, 14 ,,	16 ,, 14 ,,	15½ ,,	1 3 0
13574	16⅝ ,, 10⅝ ,,	16⅝ ,, 13⅝ ,,	12½ ,,	1 4 0
9899	18 ,, 12 ,,	18 ,, 12 ,,	14 ,,	1 4 0
12980	16 ,, 16 ,,	16 ,, 16 ,,	18 ,,	1 6 0
13900	18 ,, 13⅝ ,,	18 ,, 13 ,,	15 ,,	1 6 0
9912	18 ,, 13½ ,,	18 ,, 13½ ,,	17 ,,	1 6 0
9962	18 ,, 13½ ,,	18 ,, 13½ ,,	16 ,,	1 6 0
10982	18 ,, 13⅝ ,,	18 ,, 14 ,,	15 ,,	1 6 0
11098	18 ,, 14 ,,	18 ,, 14 ,,	12 ,,	1 6 0
9492	20 ,, 13 ,,	20 ,, 13 ,,	15 ,,	1 10 0
9208	20 ,, 13 ,,	20 ,, 13 ,,	19½ ,,	1 10 0
10251	20 ,, 13 ,,	20 ,, 13 ,,	15½ ,,	1 10 0
12964	20 ,, 13 ,,	20 ,, 13 ,,	13½ ,,	1 10 0
9909	20 ,, 13⅝ ,,	20 ,, 13⅝ ,,	17 ,,	1 10 0
12969	19½ ,, 15½ ,,	19½ ,, 15½ ,,	14 ,,	1 11 0
13781	20 ,, 15 ,, Front. / 21 ,, 15 ,, Back.	21 ,, 15 ,,	15 ,,	1 11 0
14287	20½ ,, 14⅞ ,,	20½ ,, 4⅞ ,,	17 ,,	1 11 0
7692	21 ,, 15½ ,,	21 ,, 15½ ,,	16 ,,	1 11 0
12978	20 ,, 16 ,,	20 ,, 16 ,,	17 ,,	1 11 0
13252	20 ,, 16 ,,	20 ,, 16 ,,	18 ,,	1 11 0
13220	21 ,, 15 ,,	21 ,, 15 ,,	17 ,,	1 11 0
13992	21 ,, 16 ,,	21 ,, 16 ,,	17 ,,	1 11 0
8977	21½ ,, 13⅝ ,,	21½ ,, 13⅝ ,,	18⅝ ,,	1 12 0
8976	21½ ,, 13⅝ ,,	21½ ,, 13⅝ ,,	18⅝ ,,	1 12 0
10497	21½ ,, 13⅝ ,,	21 ,, 13½ ,,	18⅝ ,,	1 12 0
8037	21½ ,, 13⅝ ,,	21½ ,, 13⅝ ,,	18⅝ ,,	1 12 0
9908	21½ ,, 13⅝ ,,	21½ ,, 13½ ,,	15 ,,	1 12 0
10404	21½ ,, 13⅝ ,,	22 ,, 14 ,,	18⅝ ,,	1 12 0
12410	21½ ,, 13⅝ ,,	22 ,, 14 ,,	12 ,,	1 12 0
13822	21½ ,, 13⅝ ,,	22 ,, 14 ,,	15 ,,	1 12 0
10515	22½ ,, 13⅝ ,,	22½ ,, 13⅝ ,,	13½ ,,	1 12 0
7924	24 ,, 14 ,,	24 ,, 14 ,,	15⅝ ,,	1 13 0
13807	24 ,, 15½ ,,	24 ,, 15½ ,,	16 ,,	1 14 0
9015B	25 ,, 14 ,,	25 ,, 14 ,,	12½ ,,	1 14 0
10932	25 ,, 14 ,,	24 ,, 14 ,,	13½ ,,	1 15 0
12944B	22 ,, 16 ,,	22 ,, 16 ,,	16 ,,	1 15 0
14037	22 ,, 16 ,,	2 ,, 16 ,,	16 ,,	1 15 0
14119	22 ,, 16 ,,	22 ,, 16 ,,	18 ,,	1 15 0

Patterns marked A have Sockets at back to connect to Retorts; all the others are flanged. Patterns marked B have curved bottoms.

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PATENT

"STANDARD" WASHER-SCRUBBER.

430

of these Machines have now been supplied, and several are now in course of erection. These facts are given as evidence of the apparatus being the most efficient of any in the Market for the extraction of

AMMONIA, CARBONIC ACID, AND SULPHURETTED HYDROGEN FROM COAL GAS.

50 of the above Machines have been constructed according to the Company's latest Patent, which has also been applied to **25** original pattern Machines.

Estimates furnished for Cost of altering original pattern Patent "STANDARD" WASHER-SCRUBBERS, or for the supply of New Machines, on application at the Company's Offices,

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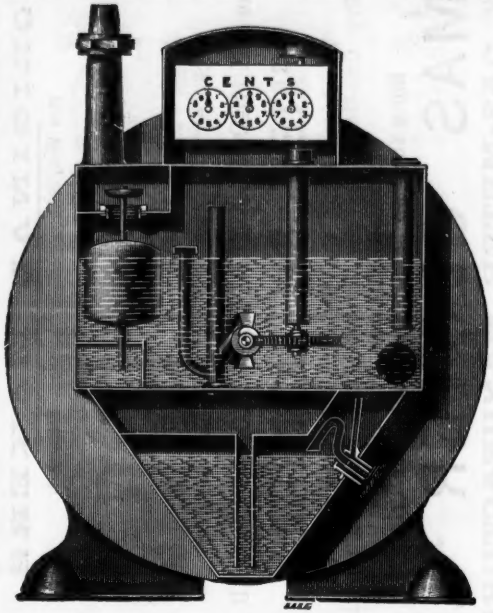
THE SYPHON OVERFLOW

— Wm. Cowan's Patent. —

To suppose, as some do, that the main object of the "Syphon Overflow" is to promote the convenience of inspectors and others who "water" meters, is to misapprehend the chief purpose of the invention. That the convenience of inspectors is promoted by the Syphon Overflow is a fact that admits of no doubt whatever, because the watering of meters is thereby greatly facilitated; but it is a mistake to fix attention upon this result, and to regard it as the only one attained. To do this is to lose sight of the chief purposes the Syphon Overflow was designed to secure.



These purposes were—

1st.—The **speedy** attainment of **exactly the same water line** on each occasion of watering.

2nd.—The **absolute certainty** of this water line being attained.

3rd.—The **impossibility** of any water afterwards finding its way into the waste-box.

The first and second of these conditions secure the interests of the gas company, whilst the third greatly promotes the convenience of the consumer, for reasons that are well known.

Who that has had experience of Wet Meters does not know the disadvantages of the "Low Spout?" The slowness with which it adjusts the water line, and the patience required while this is being done, are matters of every-day experience. It is therefore no wonder that the "Syphon Overflow" is regarded as one of the most important improvements ever made in the Wet Gas-Meter. It is not only an important improvement **in itself,** but it possesses the property of making all previous improvements more valuable and effective. It has, indeed, made the Wet Meter a more perfect, and, in every way, a more satisfactory instrument.

Narrow views as to price often prevent the adoption of real improvements; but it would be a narrow view indeed which would prefer a "Low Spouted" Meter to one with a "Syphon Overflow," because of the trifling difference in the price of the two.

— W. & B. COWAN, —

— ESTABLISHED 1827. —

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Since then we have not Exhibited for Prizes.

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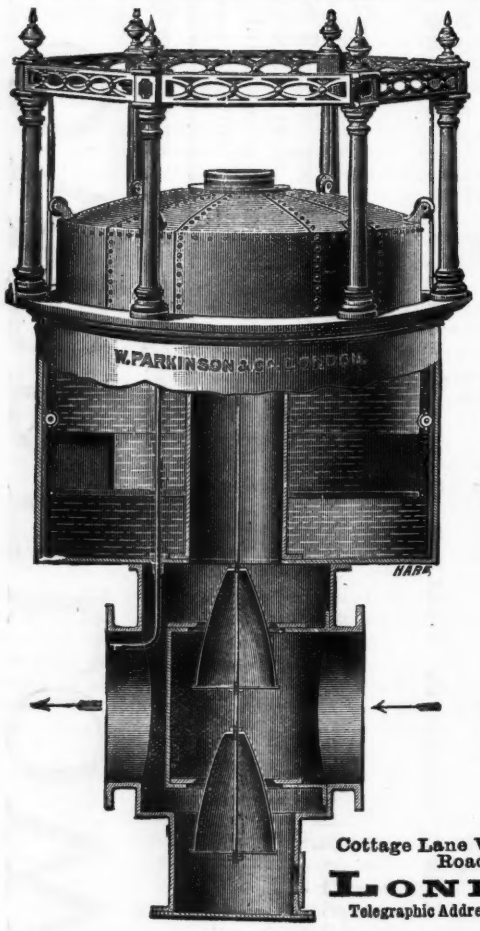
1st—Are a remedy for all the defects of Wet Meters.
2nd—Are suitable for all climates, whether hot or cold.
3rd—Incur no loss of Gas by Evaporation.
4th—Cannot become fixed by Frost, however severe.
5th—Are the most accurate and unvarying measurers of Gas.
6th—Prevent jumping or unexpected extinction of the Lights.
7th—May be fixed either above or below the level of the Lights.
8th—Cannot be tampered with without visibly damaging the outer case.
9th—Will last much longer than Wet Meters.
10th—Will not cost more than one-half for repair that Wet or Water Meters do.

Are upheld for five years without charge.



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[See also Advt., p. 924.

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TO CORRESPONDENTS.

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THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, NOVEMBER 17, 1891.

The Failure of the Judicature System.

DURING the last few weeks—since the commencement of term, in fact—there has been much discussion within and outside legal circles, respecting the relationship of the national Courts of Justice to those portions of the community who usually have most law business to transact. For some time past the Bench and the Bar have viewed with deep but silent concern the growth, among commercial and professional men, of a tendency to avoid the Courts as a means of settling disputes arising in the course of trade, and to resort to arbitration for this purpose. The first overt sign that the Bench was concerned in watching this tendency, with a desire to check it, was the re-opening of the Law Courts at the Guildhall, which was done, as the Lord Chancellor has admitted, in order to attract commercial cases back to the tribunals which those interested in such causes have displayed singular unanimity in deserting. The way in which this startling announcement was made savoured more distinctly of touting for business than has been heard of in regard to law practice since the time of the disreputable Fleet attorneys, with whose ways Dickens and Besant have made us acquainted. The noble Lord—"the law's embodiment"—has pleaded in set terms with the merchants and the professional classes of the City of London that they should return with their custom to the "old shop," and support the lawyers, as they used to be supported, by confiding to them those fat causes which are so beloved by silk and stuff gownsmen alike. The Lord Chief Justice of England has also spoken on the same side; exerting his silvery eloquence in a way that any commercial traveller might envy. But all this advocacy has been in vain. The Courts continue to be filled with libel actions, running-down cases, and personal disputes of the kind which is apt to be more entertaining than profitable; and the big commercial causes do not return. Moreover, the Judges' petition has had the very opposite effect to that which was desired—drawing attention to the reasons for the course of events complained of, and inducing business men to adhere more stubbornly than ever to their policy of "boycotting" the Courts.

This is a result which cannot surprise anybody who has had occasion to watch, or has been made to suffer from, the abuses that have invaded what is called the "dispen-" sation of justice" by the Courts. The gas industry, in common with all others, has furnished of late years only too many instances to prove that the judicature system of the country is the most scandalous of failures, if its purpose is to be taken as that of the quick, cheap, and certain administration of justice. The frustration of the Lord Chancellor's move upon the City of London will not be a lost lesson, if it serves to draw attention to the truth that there is something more than the question of locality involved in the problem of restoring the confidence of the industrial community in the administration of the law. We are proud of the spotless integrity of our Judges, and of the generally high character of the followers of the two branches of the legal profession; but the unbusinesslike arrangement for the settlement of causes results in so much practical injustice to suitors, that the very eminence of the Judges seems to add insult to the injury done by the system under which they act. Its abuses are manifold; some being obvious, and others indirect. Among the former are the tedious, unsatisfactory, and costly appeals, which again are largely due to the lack of a competent Court for dealing with commercial and industrial causes. So long ago as 1873, the City of London asked the Judicature Commissioners for a Court to be presided over by a Judge sitting with two scientific or mercantile Assessors, according to the nature of the case, whose decision should be prompt and final. How far the existing system is from answering to these requirements, may be gathered from the fact that there are still unsettled actions of high commercial importance which have been pending for five years. Appeals are a lottery as at present conducted, seeing that there is no guarantee that the farther a cause is carried the better elucidation it will receive. Among the incidental abuses of the existing system are the extravagant payments to counsel who may not earn them, and the expense thrown upon litigants by the uncertainty as to when their cases may come on for hearing.

We should very much more than fill the JOURNAL, however, if we were to set down the points on which the judicature system of the United Kingdom requires amendment in the interest of litigants and of the public. Now that the latter are taking up the matter, and settling their business disputes out of Court, it may be supposed that even the lawyers will bestir themselves to repair the shortcomings of the law. Commercial causes can be as readily disposed of by an expert who commands the confidence of both sides, as by a learned gentleman in wig and gown; and the former need depend for his information respecting the merits of the dispute only on documentary evidence, and on such straightforward explanation as those interested in the issue can give. The latter has no previous knowledge of the class of business upon which he is required to adjudicate; and he has several astute gentlemen to puzzle him with difficulties of law and misunderstanding of fact.

We hail the present discussion of this question as the most promising indication that has yet appeared upon the legal horizon, that eventually the true position of the expert in commercial and scientific disagreements will be recognized as being the bench, and not the witness-box. It may be a long time before the technical arbitrator will be enabled to deal effectually with actions in which the element of fraud enters; but in all straightforward cases relating to the execution of contracts, the quality and delivery of goods, interpretation of trade agreements, &c., there is no reason at all why, when any transaction is entered upon, it should not be stipulated beforehand that all disputes arising out of the business should be decided by a named arbitrator, whose ruling would be final and binding upon both parties. This is already the practice in many cases; and the custom may be expected to grow, notwithstanding the chagrin with which lawyers must naturally regard everything of the kind.

The Assessment Appeals of The Gaslight and Coke Company.

THE assessment appeals of The Gaslight and Coke Company will be concluded to-morrow; and it is understood that judgment will be given by the Court in the course of a week or two. It has been a heavy case for all concerned. The interests at stake are very large; and the costs of the proceedings will be enormous. Whatever view of this business may be taken by the professional gentlemen who figured in it, or who may hope for similar employment in proceedings of a like character, we are firmly of opinion that the whole affair does not redound to the credit of the legal system under which it has taken place. The device of ascertaining the value of a hereditament to a hypothetical tenant may or may not be the flower of human wisdom. It may be impossible to suggest any other means of assessing a gas undertaking for the relief of the poor. We do not presume to express an opinion upon this recondite matter of principle; but we do say that such proceedings as those which have been dragging out their weary length before Sir Peter Edlin and his colleagues on the County of London Bench, in which The Gaslight and Coke Company have been for many days defending one imaginary valuation of their property against another, are not creditable to a practical, business-like nation. The public have to pay for it all; and why the whole matter at issue could not have been settled in two or three days before an intelligent, impartial expert, can only be explained by reference to the "system." Of course, nobody is to blame for all this waste of time and squandering of money in the painful application to a particular example of general principles that have been established for the guidance of everybody having to do such business as that now in question. It is all the fault of the "system" that lawyers and surveyors and engineers should have been drafted by dozens into the Clerkenwell Sessions House to contradict one another about what an imaginary personage might or might not be expected to do in certain circumstances. How the wigs have been wagging over the rich details of tenant's capital, landlord's repairs, stocks of coal, tools, and all the other considerations which, according as they are magnified or depreciated, make out gas supply in a particular case to be either a business not worth carrying on, or an exceedingly desirable occupation! It was only to be expected that the appellants in this case should do their best to represent that their undertaking is in a very poor way. Whether this effort was not rather overdone, is a question that will be answered when judgment is given. On the other side, the Local Authorities manifested a great desire to cut up the Company's fine property to their own advantage. A marked attempt was made by Counsel for the appellants to pose before the Court as though their side had possession of all the authority competent for dealing with the issues raised; but in the Solicitor-General the respondents had an advocate not to be disposed of in this manner. The decision of the Court will be awaited with interest on more than one account, for professional reputations, as well as amounts of money payable for rates, will be affected thereby.

The Southern District Meeting.

THE members of the Southern District Association of Gas Managers met in London last Thursday, under the presidency of Mr. John Methven, of Beckton and Nine Elms. There was a good attendance, and the proceedings were of an interesting character. Mr. J. Tysoe, of East Greenwich, read a paper upon retort-stoking machinery, which produced a discussion of the usual character. This subject is one of the most important and interesting that can be brought before any body of gas managers; but it is greatly to be wished that it could be treated from time to time with a little more freshness. Notwithstanding all that has been written and said upon this question of mechanical stoking for gas-works, there is not half enough of machine work in most retort-houses, even of modern construction. The reason for this is to be found in part, no doubt, in the sluggishness of the managers of gas-works, and in the short-sightedness of directors and committeemen, who will not patronize machinery that does not show an enormous advantage, on the score of economy, over hand labour. It must not be forgotten, however, that much of the unpopularity of retort-stoking machinery has been due to the character of the machines themselves. Whatever may be said to the contrary, we are free to maintain that the drawing and charging of gas-retorts is not by any means an easy task for machinery to grapple with; and this is mainly because of the multifarious conditions under which the work has to be done. It is comparatively easy, for example, to apply machinery to such a purpose as that of elevating grain, because grain is practically as uniform in its nature as water, and a machinist knows precisely what he has to deal with in the cases of either water pumping or grain elevating. There are so many considerations affecting the carbonization of coal for gas making, however, and coals differ so greatly in their physical forms and characteristics, that it is hardly to be wondered at that many gas managers are loth to discard the possibility of intelligent adjustment which they possess in the individual stoker. Moreover, we cannot lose sight of our old point that, weight for weight, the human worker is a far more efficient agent for performing the operation of coal carbonization, upon the scale necessitated by the circumstances of most Gas Companies, than the machine which is offered in his stead. Gas-retort stoking machinery, to be truly economical, must be used in situations where it has sufficient scope; but we have yet to hear of any gas-works, however large, which depends wholly upon machinery. We prefer to discuss this subject without mentioning particular patterns or makes of machinery. The best possible type of stoking-machine may or may not be actually in the market at the present time; but we do hope that, in future discussions of this subject, the broadest view of the matter may be adopted by those who take it in hand. There was another paper read at the meeting; the author being Mr. R. Herring, of Dover, and the subject the use of oil for carburetting gas. Mr. Herring has a way of compressing oil and then allowing it to expand in spray inside an ordinary gas-retort; and he claims that this is the only economical way of using oil for such a purpose. Certainly, those gas managers who heard the paper read, and took part in the discussion, were emphatic in their scepticism as to the possibility of carbonizing oil at all in ordinary gas-retorts; but as none of them could lay claim to having tried Mr. Herring's method, they could not dispute his assertions. Nevertheless, the unmistakeable tenor of the criticism upon Mr. Herring's paper was to the effect that to put oil into gas-retorts is an error. The other business of the meeting comprised the appointment of officers for next year; Mr. A. Dougall, of Tunbridge Wells, being elected President in succession to Mr. Methven.

The Revolutions of a Consumer's Meter.

UNDER the familiar heading of "Gas Companies and the "Public," the newspapers have published special reports of the by no means very remarkable case of *Pitcher v. The Gaslight and Coke Company*, which came last Wednesday before the Judge of the Westminster County Court, sitting with a jury. The facts of the case are few and simple, as will be seen by the report which we give in another column. There was a question as to whether the index of the plaintiff's meter had or had not made a complete revolution during the quarter, which meant a difference of 100,000 cubic feet in the quantity to be paid for. Plaintiff averred that this could not have happened, while the Company's inspector considered it did; and he accordingly added, upon his own responsibility, the above-named quantity to the indicated consumption. The point at issue was essentially one of probability, inasmuch as no inspection or testing of a meter will show whether or

not it has gone "all round the clock." For the consumer, it was argued that the Company's view must be wrong, inasmuch as he had never consumed anything like so much gas in a previous quarter as this reading would amount to. On the other hand, there was evidence to show that, as a matter of fact, the consumption of gas on the premises was increasing, and that the inspector's opinion was justifiable with reference to indications of the same meter at short intervals about the period in question. In the event, however, the Court decided against the Company, who were ordered to refund the difference in excess of the average gas bill of previous winter quarters. County Court Judges make funny law sometimes; and in this case it is useless to complain, because an appeal was refused to the Company. Consequently, the best thing they can do is to admit that they have been "had" for once, and to provide the consumer with the larger meter which he evidently needs. We are not friendly to the idea of putting the full force of the law against all consumers; and in this instance, as there was a doubt about the matter, the Company would have done better if they had sued the consumer for the difference, instead of enforcing their own view of the case by a threat to cut off the gas. It was in all probability this that set the jury against them. Statutory Gas Companies enjoy certain stringent powers which are granted to them primarily in order to protect them against fraud; and we entertain the opinion that it is bad policy to use these exceptional powers in cases where there is no allegation of fraud, and where ordinary traders would be left to proceed by the ordinary course of law.

The Unification and Rating of Gas Stocks.

Our evening contemporary, the *Echo*, has once more taken up the subject of the conversion or consolidation of gas stocks, and has extended its view of the general subject to embrace the South Metropolitan stocks, which it is suggested might be advantageously dealt with on the lines already indicated with reference to the case of The Gaslight and Coke Company. This has been done probably in order to show that there is no "particularity" in the well-intentioned efforts of our contemporary to improve the condition of holders of gas stocks in relation to the investment market. Of course, what is sauce for the goose is sauce for the gander; and any reconstruction of stock arrangements that may be advised as likely to prove beneficial to one Gas Company, ought to be equally advantageous to another. It is evident, however, that there is a limit to the useful application of the process of unifying gas stocks. When the amount dealt with is but small, although it is manipulated after the Bristol pattern, it will not make a ready market; and in such cases the idea of financial reconstruction is not worth talking about. Parcels of small gas stocks may suffer, to some extent, from lack of a market in which their full value could always be had at any time; but this is a consideration that can be well taken into account by those who put their money into this class of investments, and must continue to operate until all the Gas Companies of the kingdom have a common purse. Our contemporary notes our mention of the subject of the unification of Gaslight and Coke stocks merely to say that we speak of "parliamentary "difficulties in the way." These it claims to have also remembered, but dismisses with the reflection that "as the North British, Caledonian, Great Northern, "and South-Western have all obtained the powers they "petitioned for within the past few years, it is not likely "that the Gas Companies would be refused, seeing that "many of their stock issues stand at double the price of "the old unconverted ordinary stocks of the railways "mentioned." This opinion may or may not be a just one; but we must remind the propounder of the scheme for splitting gas stocks that he has himself proclaimed it as having a close connection with the possible purchase of the gas undertakings of London by the County Council. Now, nobody, that we have heard of, has gone so far as to include the purchase of the railways as within the range of practical politics, national or municipal; and we cannot avoid the conclusion that this difference between the cases of the Railway and the Gas Companies would have a great deal to do with the treatment the latter would receive in Parliament, as compared with the former, in regard to this very matter of financial reconstruction. We doubt, however, if either The Gaslight and Coke or the South Metropolitan Company will trouble Parliament in regard to this subject, unless they are driven to take action by pressure of circumstances over which they have no control. With regard to new capital, we unreservedly approve of the course advocated in our columns last week by Mr. W. Livesey. Seven per cent. stock has no longer any reason for existence; and new sliding-scale capital may well be taken at 5 per cent., with 2s. 6d. for every penny rise or fall—thus making it the exact equivalent to 10 per cent. stock.

WATER AND SANITARY AFFAIRS.

The compact arranged between a deputation from the London County Council and one from the City Corporation, to which we made reference last week, for the promotion of a Bill in Parliament dealing with the question of the Metropolitan Water Supply, was formally endorsed by the Council at a special meeting on Friday last. The proposed measure, known as "the agreed Bill," embodies the terms arrived at between the County Council and the Corporation in May last. It provides for the creation of a Water Committee, which is to be at once "a "Statutory Committee" and a Committee of the County Council; the Corporation simply appointing one-eighth of the members. This Committee is to have power to promote Bills, which may be approved by the County Council, for a new supply of water, for the purchase of the existing undertakings, or for both these objects. It may be worthy of notice that one of the points agreed to in May last was "to take a limit of time if forced to do so." But the County Council has of late strenuously objected to any limit of time with regard to purchase. The Council also intends something in addition to the "agreed Bill." The necessary steps are to be taken in the ensuing session of Parliament to expend a further sum of money in making the inquiry "already authorized" regarding the supply of water to the Metropolis. Power is likewise to be sought which shall enable the County Council to pay the expenses attendant on the introduction and promotion of Bills on the water question. The Special Committee on Water Supply that is conducting the inquiry authorized by the General Powers Act of 1890, say they have obtained "a large "amount of information." But that which has been accomplished is insufficient, "and requires the expenditure "of much skill and labour before the Committee can "present to the Council any complete plan or proposal "for the settlement of this great question." Such is the statement contained in the Committee's report; and it is followed by the announcement that all the money which Parliament authorized the Council to spend on the inquiry will be gone by March next. The Engineer recommends that the investigation should be a thorough one—such as when finished would "probably enable the "Council to come to a decision on the whole question."

We feel sure that the County Council would be keenly disappointed if the extensive inquiry recommended by their Engineer led to the conclusion that the existing resources for the supply of water to the Metropolis were sufficient to meet all wants for many years to come, and that the quality of the supply was likewise satisfactory. The contrary of all this is to be expected; and in this instance we may predict that the expectation will receive its fulfilment. But discussions and reports are not law. If they were, we do not know what would have happened to London by this time, under the wide-spreading ambition of the County Council. At the same time, the statements put forth by that body, whether verbal or documentary, are designed to influence public opinion and to justify a policy. As for an inquiry, there could be no objection to it, if it were in neutral hands. If Parliament or the Government would undertake it, we might confidently trust that no foregone conclusion or "fad" would dominate the proceedings. On one vital part of the water question—that of sufficiency in the sources of the supply—a pronounced declaration has lately been made, in the form of a printed "Memorandum" by the Deputy-Chairman of the Council (Mr. A. H. Haggis). A number of figures are cited in this document; and at the close it is said: "The necessity, "therefore, for the provision of a new or supplemental "supply on the ground of insufficiency alone, altogether "irrespective of the question of purity, would appear to "be paramount and urgent." Whatever method may be

adopted to make up for the coming deficiency, Mr. Haggis argues that a considerable expenditure of capital "will be at "once required." The point aimed at shows itself clearly at last; the "Memorandum" finishing off with the statement that as a large outlay must immediately be contemplated (in order that the supply may keep pace with the population) so "this impending and onerous liability "must, in the event of purchase by the Council, be taken "into account in estimating the value of the Companies' "undertakings." Supposing this conclusion to be, in some degree, correct, to what does it amount? Does it follow that the requisite outlay of capital will be such as to depreciate, to any material extent, the value of the existing undertakings? The £2,368,000 of capital which the Companies have applied to the extension of their works during the last ten years, has certainly not weakened their financial position; and we need not suppose that any future outlay, even if unusually large, will do more than mpose a purely temporary check on dividends.

The Wenham Lamp Patent Action.—Owing to the length of the report of the proceedings at the meeting of the Southern District Association of Gas Engineers and Managers last Thursday, we are compelled to hold over till next week the report of the arguments and judgment in the above case.

Analyses of Scottish Cannel and Gas Coals.—Messrs. James M'Kelvie and Co., of Haymarket, Edinburgh, have issued a valuable collection of analyses (mostly by Mr. G. R. Hislop, of Paisley) of their Scottish cannel and gas coals. As several of the reports are in French and German, the series will be useful to gas engineers on the Continent. The book has been well got up; a special feature being its elaborate binding. Its appearance alone should ensure for it a place on a gas manager's table.

Mr. D. Ford Goddard has been elected Mayor of Ipswich for the current year; and we learn that he intends, at the forthcoming General Election, to contest one of the seats for the borough in the Gladstonian interest. Mr. Benjamin Scott, J.P., has been re-elected Mayor of Carlisle. Mr. Samson Fox, J.P. (of Water Gas Syndicate "fame"), has been re-elected for the third time Mayor of Harrogate. Mr. Alderman Keevney, whose name will be recollected by our readers in connection with the Hunter scandal, has been elected Mayor of Salford.

Mr. C. F. Botley, who has served his time with the Great Western Railway Company in their shops at Swindon, and has subsequently been employed as a draughtsman and assistant in connection with the gas department there, has succeeded to the position vacated by Mr. Herring on his appointment at Huddersfield—viz., a draughtsman and assistant at the Hastings Gas-Works. Mr. Botley was a silver medallist in the City and Guilds of London examinations in "Gas Manufacture" (ordinary grade) held in 1888. Before leaving Swindon, he was the recipient of an address and a handsome case of mathematical instruments from his colleagues in the works drawing-office.

Death of Mr. Charles Newton.—With great regret, which will be shared in by many readers, we have this week to announce the death of Mr. Charles Newton, which took place on the 7th inst., after a brief illness (although for some years he had been in delicate health), at his residence, "Crosslands," Croydon. Mr. Newton had been identified with the gas industry for many years, both as a shareholder and director of various prosperous companies. He was a member of the Boards of no less than nine companies, and an Auditor of two. For upwards of 26 years, he had been a Director of the Croydon Gas Company; and in March, 1887, he was elected Chairman, on the retirement from that post of Mr. Berney, who has also since died. The next Gas Company with which he became associated in an official capacity was the Worthing. He was appointed a Director of that concern in January, 1870; and eighteen months later, his colleagues selected him to preside over them. It is a curious fact that the final meeting he attended at Worthing was the twentieth anniversary of his chairmanship. At the last meeting of the shareholders—much to their regret—he declined, on the ground of ill-health, to continue in that position; and Mr. Gardner, a local gentleman, was appointed to succeed him. In 1878, Mr. Newton was elected Chairman of the Carshalton Gas Company; and in the same year he became a Director of the Sutton Gas Company. He was on the directorate of the Bournemouth Gas and Water Company, for between 13 and 14 years, and also took part in the administration of the affairs of the following foreign Gas Companies: The Colombo, since 1880; the Malta and Mediterranean and the Hong Kong and China, since 1886; and the Georgetown, since 1889. From 1885, he has been an Auditor of the Crystal Palace District Gas Company; and from 1889, of the Singapore Gas Company. Mr. Newton was held in high esteem by his numerous coadjutors; and his advice—founded as it was on such a long and wide experience—was greatly valued by them. The funeral took place at the Croydon Cemetery last Wednesday; and representatives from the various Gas Companies were present as a mark of respect. Mr. Newton was 71 years of age.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 911.)

THE condition of things in general on the Stock Exchange has not mended during the past week. It opened gloomily on Monday (the Foreign Market still being the depressing cause); and what with the wretched weather and the interruption to business caused by the Lord Mayor's Show, and the general state of apprehension, everything was as flat as it could be. There was a flicker of improvement the next day. But the gloom returned on Wednesday; and business was more or less handicapped all the rest of the week by the breakdown of communications through the gale. Altogether it was a bad week in itself; and as the anniversary of the Baring smash, it did not furnish a cheerful retrospect. The Money Market continues the same. Gold is abundant; and there is next to no demand. In the Gas Market, there were a good many transactions marked in Gaslight issues; but everything else was rather flat. The tendency was at first downward, after which a recovery took place; but, on the whole, the closing prices showed a falling off. Gaslight "A" opened at a decline, and was down to 214½ on Wednesday. Subsequent prices, however, were much better; and the old quotation was regained. There were moderate dealings in the secured and limited issues, some of which fell off a point. Nothing was done in South Metropolitans, except one bargain in "B" at 219—a low figure; but quotations did not alter. Commercial old was done "specially" at 240; and that was all. Among the Suburban and Provincial Companies, Brentford old was put down 5, and British, 2; but apparently without the result of bringing about a sale of either. Continentals were better; the Union being steady, and the Imperial a point higher on *ex div.* quotation. Of the South Americans, Buenos Ayres receded ½. None of the rest offered any remarkable feature. Business in the Water Companies was extremely restricted. The tendency was decidedly flat; and several issues have lost ground.

The daily operations were: Business on Monday was almost wholly limited to Gaslight issues, which were for the most part easier; the "A," the "B," and the 10 per cent. preferences receding 1 each. The few other stocks dealt in, however, commanded steady prices. Water was not touched. The depression of Gaslight "A" was proceeded with on Tuesday; and another 1½ was knocked off the quotation. Prices of everything else that was dealt in were also poorer. Transactions in Water showed a downward tendency. The tone on Wednesday was much the same as on the preceding day; and prices ruled at about the same level. Water began to fall, showing a drop of 2 in Chelsea and in West Middlesex, and 1 in New River. On Thursday the chief feature was the recovery of 1 in Gaslight "A," with business done at 219. Imperial Continental was also 1 higher; but British was 1 lower. Water was unchanged. The recovery in Gaslight "A" continued on Friday, with an advance of 2. British, however, fell 1 more. Brentford old receded 5; and Buenos Ayres, ½. In Water, New River fell 2½. Saturday was extremely quiet, and nothing occurred but a fall of ½ in Gaslight "A."

ELECTRIC LIGHTING MEMORANDA.

The Winding Up of the Cadogan Electric Light Company—Electrical Engineering as an Employment—Electric Lighting and Gas at Hastings—"Influence" Lighting.

ONE of the minor London electric lighting companies was brought before Mr. Justice Kekewich last week upon two winding-up petitions. This was the Cadogan Electric Light Company—a small concern that has for some time past carried on a struggling business in Chelsea, and went into voluntary liquidation in February last. Since then, however, it is alleged that the Company have gone on pretty much as before, and that the Liquidator has taken advantage of his position to discriminate unfairly between various creditors—paying some to the disadvantage of others. One petitioner asked for a supervision order, and the other pressed for a compulsory order, to be carried out by himself. In the event, the Judge made the usual order on the first petition, but no order on the second, which he seemed to think went beyond the necessities of the case. As it is, however, creditors will be protected, and the assets of the Company will not be spent in carrying on the business and making new installations. The undertaking, such as it is, is in course of being transferred to a new Company already formed. According to the report of the Surveyor to the Chelsea Vestry, although there are three electric lighting companies carrying on business in the parish, of which this Cadogan Company is one, the use of the light in private houses does not spread very quickly.

If one were to judge from the advertisements which constantly appear in the newspapers, inviting parents and guardians to apprentice their sons and charges to electrical engineers who generally describe themselves as "in a large way

of business," it might be thought that electrical engineering is a very flourishing and desirable profession. This impression would be deepened by a perusal of the report of the last Technological Examinations held by the City and Guilds of London Institute, from which it appears that this year there was a large increase in the number of candidates in the electrical subjects. "In Electric Lighting," to quote from the report, "392 candidates presented themselves this year, as against 256 in 1890; and the number of successful candidates has increased from 173 to 262." This is, comparatively speaking, an enormous number of candidates for a subject which cannot, as a regular calling, provide means of livelihood for anything like a corresponding number of proficients. The whole industry of gas manufacture only mustered 43 candidates for the same examinations; and, making every allowance for the fact that, for the purpose of passing an examination, electricity is a subject much more easily worked up than gas manufacture, it remains obvious that the presentation before the Institute of 392 candidates in the electric lighting classes for one year is a gross exaggeration of the true necessities of the industry. Possibly this phenomenon is not unconnected with such proceedings as those which were recently exposed in Court, when an electrical engineer, who was shown to have about sixty-five apprentices to seven or eight workmen, was condemned to pay the mother of one of the so-called "pupils" damages amounting to £120, with costs of the action, for failure to carry out his engagements towards the latter. The public cannot be too often warned that electrical engineering supplies a fruitful field for premium-hunting; and that even those who learn the trade of electric lighting will not for many years to come find much profit in practising it.

As will be seen from the article in another column, some interesting points in relation to the comparison between electric lighting and gas for outdoor promenades, &c., are transpiring in connection with the lighting of the sea-front at Hastings and St. Leonards. It must be borne in mind that the Marine Parade at Hastings is about 2¾ miles long, and that 2 miles of it is lighted with 100-candle gas-lamps, which are in modern gas engineering practice esteemed as the best equivalents to arc lamps. The remaining portion of the Parade is lit by means of electric arc lamps, which are in addition to the previously existing 5-feet gas-lamps, and have been in use from sunset to eleven o'clock for the last seven years. These lamps cost £30 per annum, and the gas-lamps £4 4s. 2d. As there are 15 of the former, costing a total of £450 for electricity, and 30 of the small gas-lamps, costing £126 5s., the gross total cost of lighting this three-quarters of a mile of the Parade amounts to £576 5s. It has been suggested to replace this mixed system with 40 "Whitehall" gas-lamps, burning at 100-candle power up to eleven o'clock, and one burner afterwards, at a charge of £10 13s. 8d. per lamp, or £427 6s. 8d. per annum. These large gas-lamps would be 30 yards apart; whereas the electric arc lamps are 100 yards apart. On the rest of the Marina, the gas-lamps are 40 yards apart; and if this spacing were adopted for the portion in question, the saving by gas (which, according to the suggested plan, would be £148 6s. 8d. per annum) would be increased to £202 6s. 8d. as compared with the present mixed system. It goes without saying that 100-candle gas-lamps, spaced 30 or 40 yards apart, have a much better effect than flickering arc lamps 100 yards apart, with the small gas-lamps necessary to guard against accidental extinctions interspersed among them.

Professor J. J. Thomson has taken up the subject of vacuum bulb lighting, which has also been studied with brilliant experimental results by Mr. Tesla. An account of Professor Thomson's investigations has appeared in the *Philosophical Magazine*. The object of the inquiry was originally the examination of the phenomena attending the discharge of electricity through gases when the conditions are simplified by confining the discharge throughout the whole of its course to the gas, instead of, as in ordinary discharge-tubes, making it pass from metallic or glass electrodes into the gas, and then out again from the gas into the electrodes. The beautiful effects produced in the latter way, by what is called the electrical *effluve* in Geissler tubes, are the commonplaces of the lecture-room. To procure electrical effects in closed tubes or bulbs without electrodes is a question of influence or induction; and the compelling force must be very intense while it lasts, although it need not last for more than a short time. Forces satisfying these conditions occur in the neighbourhood of a wire through which a Leyden jar is being discharged. When the experiment is properly conducted, the vacuum tube subjected to the influence is filled with a bright light, which is not flame, but has almost all the appearance of it. Commenting upon Professor Thomson's statements, the *Electrician* remarks that "in many ways a glow lamp, consisting of a mass of electrically excited gas, is an ideal source of light. Its efficiency is many times as great as that of an ordinary glow lamp, while the large amount of luminous surface is also a great point in its favour. Its practical use is, however, problematical, owing to the difficulties attending the production of currents of the requisite frequency, and in transmitting energy by their means with any reasonable efficiency." This caution is perfectly justified, as a warning against the assumption that the experimental success of influence lighting is necessarily a prelude to its wholesale production. All the same, the results are very striking.

A CHECK FOR THE NEW UNIONISM.

ALL sincere well-wishers of the British Workman must rejoice at the result of the ballot on the question of continuing the recent partial engineers' strike in the Newcastle district, when, by a large majority, it was decided to resume work upon terms that had been previously agreed between Committees representing both parties. The circumstances are worthy of some consideration, not only on account of the principles involved in this dispute in the engineering trades, and in the method of its settlement, but also because of the light thrown by this incident in labour politics upon the ways and the desires of Trade Union leaders. The question ostensibly settled by the Newcastle ballot was that of overtime; but really and truly it was the much deeper question whether the local branches of the great Union of the Amalgamated Engineers were to be managed in the interests of the working members, or after the methods of the New Unionism. It is unnecessary to go at length into the condition of the overtime question, as this existed before the lock-out and strike. Practically, there was no such disagreement between the employers and the men in regard to this matter but might have been cleared up long since by an amicable talk on the subject between the two parties; and the terms upon which the men have now returned to work are no different from the conditions that the employers would have granted for the asking at any time during the past twelve months. There is one point of the settlement of which employers and workmen in other trades may profitably take notice—that, in future, overtime is to be counted on the week's work, and not from day to day. So by this wise arrangement there will be no "losing quarters" at the ordinary rate of pay, and making up for it, at the employer's expense, by working late for time-and-a-quarter, or time-and-a-half.

This, however, and the other regulations applying to overtime which possess a more local significance, and which are put forward officially, as the "settlement" resulting from the lock-out and strike, compose only one-half of the story, and by no means the more important half. The other consideration more or less disposed of by the same ballot was, as has already been remarked, the far more serious one as to whether or not the principles of the New Unionists were to prevail with the Amalgamated Engineers. This numerous and influential Society wants a Secretary; and several individuals who have taken to Trade Unionism as a business are known to be looking very keenly after the job. Among these is Mr. Tom Mann, who, although known to Fame only as the leader of the Dockers, is not, and never has been, a working member of that interesting body. He is a member of the Amalgamated Engineers, however; and he entertains the conviction that he could manage this Society very much to the general advantage, not excluding his own. But there is at Newcastle an active and efficient branch official of the Society, who is nearly as adept in the methods of the New Unionism as either Tom Mann or John Burns; and the story goes that this acute individual is also "in the running" for the vacant secretaryship. However this may be, there was pulling the strings upon the men's side at Newcastle somebody who was suspected of desiring the *kudos* that would have been earned by the successful management of a strike. It is only on this hypothesis that an acceptable explanation can be suggested, of the fact that during the whole course of the Newcastle dispute, although the spokesmen for the men professed to be desirous of co-operating with the employers for bringing about an acceptable settlement, there was an undercurrent of agitation making for war.

There is reason to believe that the wire-pullers of the movement did not keep perfect faith either with the masters or with the men for whom they professed to act. For instance, although a basis for a settlement of the matters ostensibly in dispute had been agreed upon between a Committee of the Employers and a deputation from the men's Joint Committee, and bore the signatures of duly accredited representatives of both sides, this was persistently described by the Union leaders as the "masters' proposals." Again, although the strike and lock-out affected only the Tyne and Wear districts, it is asserted that steps were taken to procure votes from outsiders known to the officials to be "safe." All this scheming notwithstanding, the cardinal point that the men's decision had to be given by ballot, was sufficient to defeat the professional agitators. It is stated that 13,000 ballot-papers were issued, but not half of them were used. These papers were of a distinctly question-begging cast, since they bore the words "For the masters' proposals" as the form for affirmation. The object of this peculiar manner of putting the question is obvious enough. It was thought that many men would negative such a query as a matter of course; and it is believed that the device was successful with some of the more thoughtless of the men. But the issue was too plain to be disguised by any such trickery. Indeed, it is stated that, ballot or no ballot, the same result would have followed, and that many of the men did not take the trouble to fill up their papers simply because they had resolved to return to work the following week. On the other hand, the negative vote is reasonably held to signify the extent of the influence of the wire-pullers who did not desire peace.

Another effect of this remarkable vote is the discredit which it throws upon the mass-meeting system, which is so beloved by the whole tribe of professional agitators. The officials of the

Union in this case organized meetings, and assiduously spread the report that, as late as the day before the ballot, "feeling ran high against the proposals." Now, it is clear that if the views of the men with regard to the continuance of the strike had been gathered only from mass meetings, as in the case of Gas Workers' and Dockers' strikes, the leaders would have had everything their own way. They could have prolonged the strike to any length they pleased, and have terminated it by forcing, with a flourish of trumpets, the open door of the employers' goodwill. Needless to say, those who could have tacked to their names the renown for such a triumph would have ranked high in the hierarchy of Agitation. It is almost possible to sympathize with the disappointed wire-pullers upon the dramatic collapse of their schemes. That which John Burns has called "the strike policy" was sorely in need of an unquestionable victory, when circumstances at Newcastle seemed to offer a reasonable prospect that something of the kind might be "pulled off" there. The Amalgamated Engineers had plenty of money for fighting with, if need arose, and "No Overtime" was a capital cry to fight upon. It offered an answer to the carpers who have maintained that the apparent popularity of the Eight-Hour movement in some quarters indicates no more than a desire on the part of the simple workman to be able to charge overtime at an earlier hour of the day than he can at present. If it could be shown that there was a whole country-side willing to strike against the very notion of overtime, how much impetus would be imparted thereby to the Eight-Hour movement! At any rate, some of the Eight-Hour men appear to have looked at the case in this light; for Mr. Tom Mann, although he must have felt annoyed at seeing someone else pulling the strings of the Amalgamated Engineers while he is forced to spend his days in dignified but unprofitable employment at Westminster, hastened to throw the weight of the *Trade Unionist* on the side of the Newcastle strikers.

The employers, however, had a policy of their own, and they also had the courage of their opinions. They were organized in defence of their common interest; and they let the world know that the cry against overtime was purely factitious. They saw the hand of the New Unionist in the movement, and perceived that unless they made a stand they would lose the control of what has hitherto been their own business. Consequently, it was soon made evident that while the attitude of the employers was such as to knock the bottom out of the "No Overtime" pretensions, they would sooner shut up their works forthwith than permit Union officials to dictate how the works should be carried on. And they have their reward. The Tyneside engineers are not the same sort of workers as the long-shore casuals for whom Messrs. Clem Edwards and Co. undertake to speak. They seem to have allowed their official leaders to open the ball in their name, and to carry on the so-called dispute with the employers until the outcome of the affair could be perceived in the form of a mutually acceptable settlement; and then they quietly went back to work, and the "strike policy" made another "fizzle."

Meanwhile, it is interesting to observe that none of the stock-in-trade of the ordinary Trade Unionist of the so-called "new" variety was used in this North-Eastern dispute. There was not a trace of Eight-Hourism about the whole affair; but, on the contrary, the Tyne and Wearside engineers have been quite content that the limits of compulsory work—which is a very different thing from the compulsory limits of work—shall be 65 hours a week, and this decision, as *The Times* remarks, "has been reached in the heart of the very city where the Trade Union Congress held its last meeting." Can there be any stronger proof that Eight-Hourism, as preached by Mann, Tillett, Aveling, and Co., is the emptiest of "academical" questions in the estimation of the mass of intelligent artizans? This incident shows once more that the resolutions of such a gathering of odds and ends as the Trade Union Congress have no force whatever with men who really and truly earn their living by their hands, and not by their tongues and pens.

Again, there was no talk on Tyneside of "blacklegs" in connection with this lock-out and strike, and no attempt to convince the local public that the employers had not an equal right with the men to their own view of the points in dispute. The parties who found themselves for the time at cross-purposes were too conscious of their own and of each other's strength to feel any impulse to indulge in "tall talk" about what they did or did not intend to do. The rhodomontade about the "Rights of Man," and so forth, with which the Clerkenwell Green rhetoricians amuse their Sunday afternoon audiences, was out of place in this connection; nor did banners sensibly affect the issue. Brickbats played no part in the proceedings; and we have no intelligence of any libel actions as having been necessitated by anything that a representative of one side said about his opponents. On the whole, therefore, the North-Eastern Engineers' dispute must be characterized as a labour difficulty of a distinctly old-fashioned kind; and Messrs. Burns and Mann must feel that they were well out of it, seeing that it afforded no scope for the exercise of their peculiar gifts. Evidently, the mechanics of the Tyne and Wear are not yet educated up to a proper appreciation of the beauties of the New Unionism. With a tithe of their resources, the Gas-Workers or the Dockers would have gone on striking until all the trade had been driven out of the neighbourhood, or until the employers had been forced to close their yards to Society men.

NOTES.

Strange Flames.

In connection with the research that is being made into the problem of the production of light by other means than by combustion, it is of interest to remark some of the experiments of M. Moissan upon the gaseous element fluorine, which he has recently succeeded in isolating. Fluorine seems to answer to that ideal conception of the old alchemists—the universal solvent. It possesses most intense chemical activity. The gas is obtained by electrolysis, conducted under a variety of ingeniously devised conditions necessitated by the corrosive nature of the product. Many different sorts of flames are produced by allowing fluorine gas to come into contact with other elements. With hydrogen, combination takes place explosively even at a temperature of — 23°, and in the dark. If a tube delivers fluorine into an atmosphere of hydrogen, a very hot blue flame, bordered with red, at once appears at the end of the tube. Bromine vapour combines with fluorine in the cold, with production of a very bright, but low-temperature, flame. Iodine gives a pale flame; phosphorus and arsenic combine with fluorine with lively incandescence. Carbon in a finely-divided state combines with fluorine even at ordinary temperatures. Purified lamp-black inflames instantly with great brilliancy; as do also the lighter varieties of wood charcoal. The amorphous variety of boron likewise ignites instantly in fluorine, with projection of brilliant sparks; but the most beautiful of all these extraordinary displays of chemical activity is the reaction between fluorine and silicon. The cold crystals immediately become white hot, and then burn with a very hot flame, scattering showers of stars in all directions. Many other substances burn in fluorine, according to details published by M. Moissan in the *Annales de Chimie et de Physique*. The reason for some of the flames produced being of low temperature, though of high illuminating power, is a matter demanding further investigation.

Suggested Light Standards.

Writing in the *Electrical Review* upon the subject of light standards, Mr. Ralph Conrad Richards remarks that the parliamentary standard candle is far less constant in its light-giving qualities than the many devices against which it is compared for the purpose of arriving at a constant secondary standard. He observes that the regulation gas-burner furnished with a Methven screen is far preferable; and he states that experience shows the latter to be "one of the most constant things of the kind capable of reproduction." With regard to the rating of candles by the quantity of material consumed, Mr. Richards remarks that their performance does not depend so much upon the amount of organic substance consumed as on the conditions affecting this consumption. Therefore the regularity of the wick is an important matter; and the question of the temperature at which the test is made renders it still more so. Stearine at a temperature of 50° Fahr. is a hard, compact material; while at 70° it is far softer, and therefore more readily susceptible of volatilization. Heat also, Mr. Richards remarks, powerfully facilitates combustion. The following list of proposed working standards, as compiled by Marx, is given, with additions by Mr. Richards:—

Standard.	Grains per Hour Consumed.	Light in Standard Candles.
Stuttgart standard wax, 4 to 1 lb.	119·6	1·0
Stearine, 5 to 1 lb.	153·7	1·0
„ 4 „	146·7	0·9
Paraffin, 8 „	111·1	1·1
American sperm oil (sp. gr. ·808)	233·1	3·2
Photogen oil (·810)	220·7	3·0
Shale oil (·817)	223·8	3·0
Rape oil (usual purified)	307·4	2·8
Coal gas (at 21 mm. pressure)	4·5 cub. ft.	6·0
„ (at 8 mm. pressure)	—	10·0
Paraffin oil, sp. gr. doubtful (Richards)	700	7·0
Kerosine (Richards)	475	3·5

A Gas-Indicating Safety Lamp.

According to the results of experiments carried out by Dr. Frank Clowes, of the Nottingham University College, a handy safety lamp for use by gas-fitters and about a gas-works would be Ashworth's improved Hepplewhite-Gray lamp. This lamp is of special construction, burns benzoline from a sponge reservoir, and its flame is surrounded by a glass cylinder which is ground rough at the hinder part. This latter device prevents the appearance of numerous reflected images of the flame, and the other reflection appearances, which are seen from a smooth glass surface, and which render the observation of a small pale flame cap very difficult, if not impossible. The wick of this lamp when at a normal height furnishes a flame of great illuminating power. When the wick is lowered by a fine screw adjustment, the flame becomes blue and non-luminous, and does not interfere with the easy observation of a pale cap due to the presence of inflammable gas in the air. The extreme sensitiveness of this flame as a test for the presence of gas in the atmosphere, is shown by the fact that in air containing 0·5 per cent. of methane, a flame cap 7 mm. high is observable; with 1 per cent., the cap increases to 10 mm.; with 2 per cent., to 14 mm.; and with 5 per cent., to 30 mm. The cap, which with the lower proportions of gas was somewhat ill-defined, became remarkably sharp and definite when 3 per cent. and upwards of methane was present. But even the lowest percentage gave a cap easily

seen by an inexperienced observer. It is well known that gas-fitters are often unable to detect the presence of gas in an enclosed space by the sense of smell, which in their case becomes vitiated by their long exposure to the odour of old gas-pipes, &c. This lamp would thus supply a safe and certain means of detecting the presence of gas in air, and so might prevent many explosions.

The Difference between Natural and Artificial Asphalts.

A correspondent of the *Railroad and Engineering Journal* writes learnedly on the subject of asphaltic paints, and takes occasion to lay stress upon the essential difference between natural asphalt and certain coal-tar products. He declares that a well-made paint, the body of which is true natural asphalt, can be subjected to any amount of heat not exceeding that of boiling water, and even on vertical surfaces will not run. Moreover, its covering power is great, and its toughness and adhesiveness remarkably enduring. The use in trade of the term asphalt as applied to certain coal-tar products has led to some confusion of mind upon the subject. The writer points out that, while these artificial products bear a certain resemblance in some of their physical properties to natural asphalt, the two commodities are chemically very dissimilar. They are, he states, so wide apart in their natures, that it is as improper to classify them under the same name as it would be to confuse "things volatile and involatile, or destructible and indestructible." There is no product of coal tar, short of the final residuum of coke in the still, the constituent oils of which do not gradually volatilize in the sun's heat; and coal-tar products suitable for use as paints also easily become fluid when exposed to sun heat, until by evaporation they become so far brittle as to solidify, after which, a little further progress in the same direction causes them to perish and scale off. On the other hand, the constituent oils of natural asphalt are absolutely non-volatile at the highest sun temperature, and the material does not oxidize under any atmospheric conditions.

Resignation of the Town Clerk of Leeds.—At the meeting of the Leeds County Council on Monday last week, a letter was read from the Town Clerk (Sir George W. Morrison), in which he stated that, according to medical testimony, he was suffering from mental strain, and did not feel equal to conscientiously discharging the duties of his office. He therefore deeply regretted to have to place his resignation in the hands of the Council. It was decided that the letter should be considered at a special meeting. Sir George Morrison was appointed Town Clerk in 1878, and was knighted in 1885.

The Transactions of the Societe Technique.—We have received the volume of Transactions for the present year of the Société Technique du Gaz en France. It contains the report of the proceedings at the eighteenth annual congress of the Society, held in Paris last June, with the full text of the papers presented thereat (most of which have been already noticed in the columns of the JOURNAL), and the discussions to which they give rise. In a supplement to the matter specially relating to the Society, M. Victor Delahaye supplies an abstract of cases affecting the gas industry which have lately come before the Courts; so that the volume is a record of legal as well as technical progress. The various communications are illustrated by eleven large lithographed plates.

Presentation to Mr. W. Patmore.—On Friday last an interesting gathering took place at the offices of the South Metropolitan Gas Company; the occasion being the presentation of a testimonial to Mr. W. Patmore, an old and esteemed officer of the Company. Mr. C. Howard, the Chief Inspector, presided; and, in making the presentation (consisting of an illuminated address signed by all the staff officers, an easy-chair, together with a clock and pair of vases), referred in feeling terms to the cordial relations which had always existed between the recipient and his colleagues, and expressed the hope that he might be spared for many years to enjoy his well-earned retirement. Mr. Patmore thanked his brother officers most sincerely for so handsome a testimony of their good feeling towards him, and for their consideration and cordial assistance during the time they had been associated together.

Sulphate Plant at the South Metropolitan Gas-Works.—There has lately been erected, at the Old Kent Road station of the South Metropolitan Gas Company, complete apparatus for the manufacture of sulphate of ammonia. The plant consists of two stills, each capable of working up 70 tons of liquor per day, supplied by Mr. H. Simon, of Manchester. The saturators are on the self-discharging plan patented by Mr. T. Wilton. They were made by Mr. M. Schwab, also of Manchester, who likewise did all the lead work, the store-room, and acid-tank lining, and put up the elevators for the acid and mother liquor, &c. In addition to the foregoing, sulphur-recovery plant has also been erected; but this has been designed on the plan of the Company's Chief Engineer (Mr. F. Livesey), and erected by themselves. He has introduced a new system for the deposition of the sulphur; the object being to more rapidly condense the steam formed by burning the hydrogen of the sulphuretted hydrogen. After leaving these chambers, the waste gases pass through chalk towers, and then on to oxide purifiers. We learn that the sulphate stills are found to be capable of dealing with slightly more than the normal quantity of liquor; while the saturators are doing everything that was promised.

TECHNICAL RECORD.

SOUTHERN DISTRICT ASSOCIATION OF GAS ENGINEERS AND MANAGERS.

The Autumn Meeting of this Association was held last Thursday, at the Holborn Restaurant—the PRESIDENT (Mr. John Methven, of The Gaslight and Coke Company) in the chair. There was a good muster of members and friends.

The usual routine business first occupied attention.

MINUTES OF LAST MEETING.

The HON. SECRETARY (Mr. J. W. Helps, of Croydon) submitted the minutes of the meeting held at Windsor on May 14 last; and they were confirmed.

ELECTION OF OFFICE-BEARERS.

Mr. C. C. CARPENTER (Vauxhall) said he had a somewhat difficult duty to perform—that was, to propose a President to follow in the footsteps of his friend, Mr. Methven. But had it been his own selection, he did not think he could have chosen anyone who was more fitted for the position than his friend Mr. A. Dougall, of Tunbridge Wells. He had therefore much pleasure in proposing that this gentleman be the President during the coming year.

Mr. JOHN WEST (Manchester) said he had great pleasure in seconding Mr. Carpenter's proposition. Having known Mr. Dougall for many years, he was able to say that he had thoroughly endeared himself to the members of the Association, and that he would carry out the duties of the chair to their satisfaction.

The motion was carried unanimously.

Mr. DOUGALL thanked the members very heartily for the honour they had conferred upon him. It was, he said, with much diffidence that he accepted the office; but he did so relying upon their forbearance and their co-operation in trying to make the year a successful and profitable one.

Mr. FRANK LIVESEY (London) moved that Mr. H. G. Mitchell, of Hornsey, and Mr. Charles Gandon, of Sydenham, be elected to fill the vacancies on the Committee caused by the retirement of two members by rotation.

Mr. S. W. DURKIN (Southampton) seconded the motion, and it was passed.

The PRESIDENT said the next business was the election of the Secretary and Treasurer; and he had the greatest pleasure in proposing that Mr. Helps, who, he understood, was willing to serve again, should be re-appointed. It was not necessary for him to make any remarks as to his capability for the office; seeing that he had conducted the affairs of the Association to the satisfaction of the members for so many years.

Mr. T. MAY (Richmond) seconded the motion, which was cordially agreed to.

The PRESIDENT remarked that they had next to elect the Auditors. This position had been filled by Mr. C. C. Carpenter and Mr. E. Price. The first-named gentleman was willing to serve again; but Mr. Price regretted his inability to continue in office. He had therefore the pleasure of proposing that a hearty vote of thanks be passed to Mr. Price for having undertaken the duties since 1877; and they would ask the Secretary to convey to him their expression of regret that he felt himself compelled to relinquish the post.

The proposition was heartily carried.

On the motion of Mr. ROBERT MORTON (London), seconded by Mr. JOHN SOMERVILLE (London), Mr. W. H. Broadberry was elected to fill the vacancy.

The motion having been carried, Mr. Carpenter was afterwards re-appointed.

NEW MEMBERS.

The following gentlemen were then elected members of the Association: Mr. T. N. Ritson, of Jersey; Mr. J. H. Carvosso, of Dartford; and Mr. D. Irving, of Bristol.

Mr. J. TYSOE (East Greenwich) next read the following paper entitled—

CARBONIZING BY MACHINERY.

Having been asked to read a paper before the members of this Association, and finding no record in the annals of the Society of any treatment of mechanical stoking, I decided to put together a few facts gathered during the course of my experience with the most recent form of stoking machine which is in use at the works under my charge. The subject has recently been most exhaustively dealt with by Mr. West before a kindred institution; and following him, I cannot hope to impart much that is new. But I know that a great deal of doubt and misconception exists in the minds of many concerning the benefits to be derived from mechanical stoking—fostered to a great extent by the publication of erroneous and misleading reports of deputations, consisting for the most part of gentlemen who have no technical knowledge of the subject which they are supposed to investigate, and who are not careful to note accurately the information supplied to them—and should I succeed in throwing any light on the matter by an account of what is actually being done, this paper will not have been written in vain.

The form of machinery in use at East Greenwich is the latest outcome of the inventive genius of Mr. John West; the power

being transmitted by the wire-rope system. I propose to give a short general description only of the machines—the object of this paper being not to describe the details of the apparatus employed so much as to record the results obtained therefrom. The machines, when first erected in 1887, were worked independently with a boiler and engine on each; and, when fully equipped and in working order, the respective weights were approximately 14 tons for the charger and 10 tons for the drawing machine. These were the first machines constructed on this principle, and will probably be the last. We struggled with them for a time; but it was hopeless. Stoppages would generally occur in the night time, when men could not be readily obtained to continue the work. The whole retort-house work was completely disorganized, and everyone concerned thoroughly sick of the whole business; and it was decided that engines and boilers travelling up and down a retort-house floor were very much out of place, and that some other motive power must be adopted before we could do anything with the machines. About this time Mr. West was experimenting with the application of the wire-rope system to his machines; and with such success, that Mr. Frank Livesey, our Chief Engineer, decided to adopt the principle, and arranged with the West's Gas Improvement Company to remove the boilers and engines and erect the machinery necessary for working with wire ropes.

At East Greenwich all the retorts, which are 21 inches by 15½ inches, D shaped, are set in beds of ten in five tiers; and to charge and draw the four top retorts by hand, a travelling stage about 4 feet above the ordinary stage-floor is in use. The conditions are much more adverse to the employment of machinery than in beds of the ordinary height, as the machines have to be made so much heavier, which means increased initial cost and extra wear and tear. With the first machines, we had no extra travelling-stages to draw and charge the top retorts in the event of a breakdown; and we had to improvise a stage for this purpose with wooden trestles and planks, and as these were frequently brought into requisition, it will readily be seen that the position was not an enviable one.

The alterations were completed early in the present year; and in March the machines were started, and have been constantly at work up to the present day with eminently satisfactory results. The accompanying illustrations, figs. 1, 2, and 3, will show the general arrangement of the machinery and retort-house. The

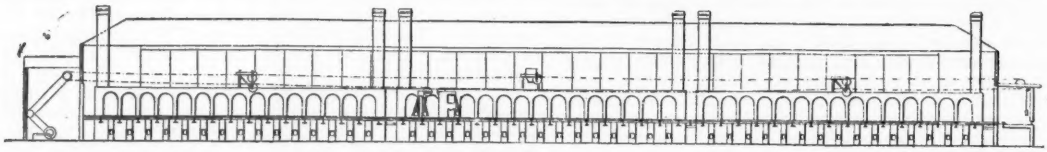


FIG. 1.

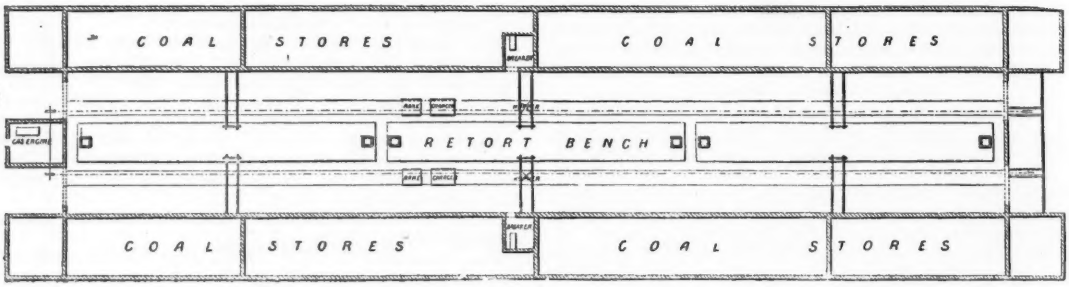


FIG. 2.

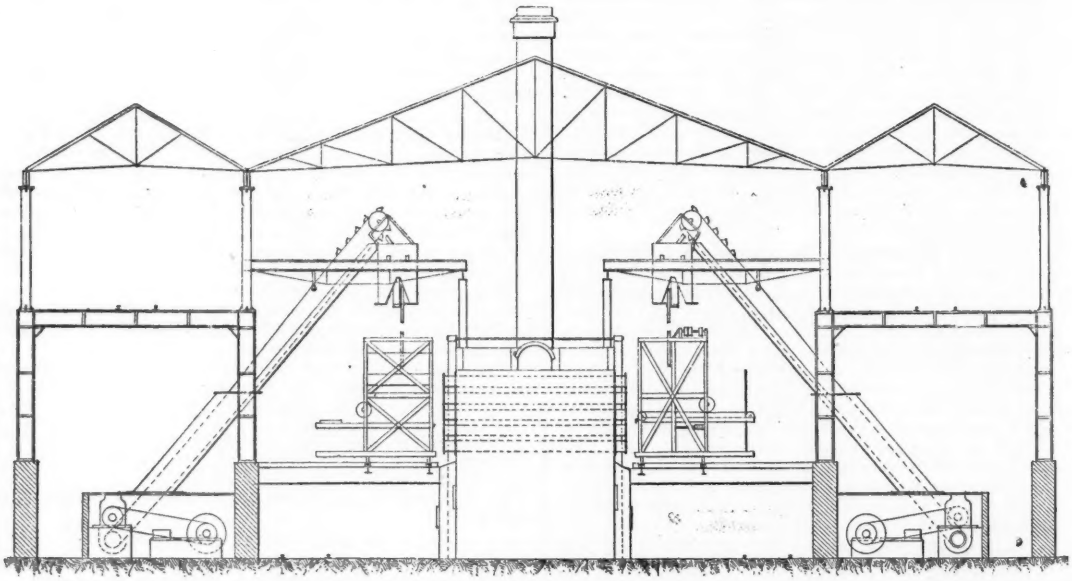


FIG. 3.

benches are erected in three sections, fifteen beds of ten in each section, with a 6-foot passage at the ends. At present machinery is only in use in the middle section of one house; but a further extension is contemplated. The motive power is derived from a 16-horse power "Otto" gas-engine, situated at one end of the house. A belt from this drives a countershaft on the wall, on which run fast and loose pulleys, and from which the main shaft above carrying the rope pulleys is driven. The steel rope, of ⅜ inch diameter, traverses the entire length of the house, and passes round a grooved pulley at the further end, which is fixed to a carriage running on wheels between two girders. This carriage is weighted sufficiently to keep the rope to the required degree of tautness. At three intermediate points, on account of the length of the house, the rope is supported by carriers to keep it at a sufficient height from the floor. The bottom of the rope passes once round a large grooved pulley on each of the machines; and this pulley works the gearing by means of which the various motions are manipulated and controlled.

The power is transmitted to the various movements of the machines by 3½-inch double leather belts; and the situation is a very trying one for belts—in fact, it would be difficult to find a worse one. High speed, pulleys of small diameter, short belts, constant shifting from pulley to pulley in reversing, heat and coal-dust combined, are conditions under which the best belts might well fail. But notwithstanding this, we are not greatly troubled in this respect—probably owing to the frequent examination which the belts receive between the draws. Frequent examination of all parts is absolutely necessary, in order to minimize the risk of a breakdown. It is perhaps not a position to be particularly proud of; but I consider myself to be somewhat of an authority upon the results of a breakdown during a draw, as with the original machines, with self-contained boilers and

engines, my life and the lives of the carbonizing foremen were rendered a misery from this too frequent occurrence. I do not wish it to be understood that we have absolutely no trouble with the present form of machines; but what trouble there is, is confined to the charging-machines and the elevator chains used for carrying coal from the coal-breakers to overhead hoppers which supply the hoppers on the charger. It would be strange, taking into account all the conditions under which they are working, if a hitch did not occur sometimes; but the best material and workmanship having been employed in their construction, it only remains for reasonable care to be bestowed upon the maintenance of the various parts, to ensure practical immunity from stoppages of any kind. Much trouble has been caused in some places by the driving-rope; and I fully expected we should meet with a like experience. But after more than eight months constant work, the rope appears not to have suffered in the least, which speaks volumes for the excellence of the material of which it is made.

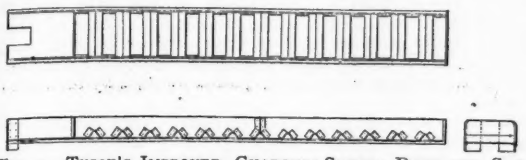
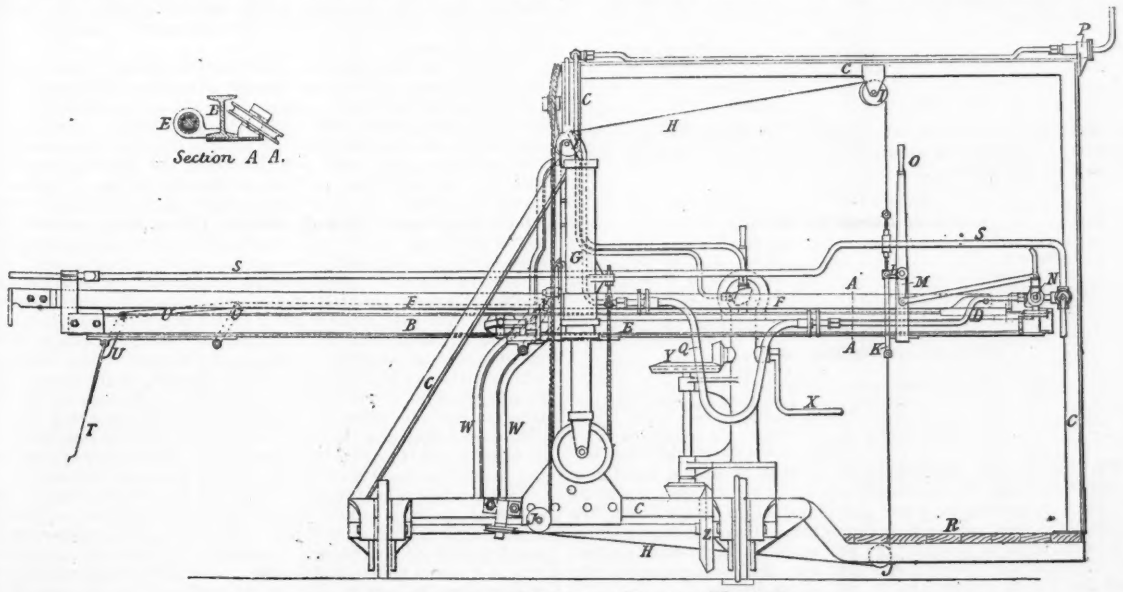


FIG. 4.—TYSOE'S IMPROVED CHARGING-SCOOP: PLAN AND SECTIONAL ELEVATION, SHOWING THE SCOOP OPEN AND CLOSED RESPECTIVELY.

The rake is the more simple machine of the two; and there being fewer parts, and the whole affair much lighter than the charger, we have practically no trouble with it. In the hands of a competent driver, six strokes are usually sufficient to discharge a retort; and this process is effected in about 40 seconds. The form of scoop in use with the charger is semi-circular in section, with a plate or midfeather running down the centre longitudinally. The capacity of the scoop is 1¾ cwt. when filled; and it enters the retorts twice at each charge. By means of reversing gear the scoop is turned over to the right and left alternately; the object being to distribute the charge more evenly along the bottom of the retort.

I am at present experimenting with a scoop of my own design, from which I hope to obtain good results. I was led to the consideration of the subject by the desire to dispense with as much gearing as possible; and the turnover and reversing arrangements of the scoop as supplied to us, although very good in action, are liable to frequent disorder. The scoop I have devised (shown on drawing, fig. 4), is constructed with a sliding bottom plate containing twelve ports 3½ inches wide, with 3½-inch spaces between. Inverted V-shaped pieces corresponding with the ports are fixed across the scoop, and riveted to the sides. When the scoop is filled with coal, the ports are under the V-pieces, and consequently closed. Rods are fixed to the sliding bottom working along a guide-rod, on which, at the required position, a stop is fixed. As the scoop is propelled into the retort, at the position of 3½ inches from the end of the stroke, the rods connected to the sliding bottom catch against the stop; the effect being to hold the bottom in position whilst the rest of the scoop travels another 3½ inches, when all the ports are opened, and the coal discharged into the retort instantly. On being withdrawn, a similar stop at the other end closes the scoop ready for another charge of coal. On the front end, projecting below the bottom, a plate is fixed which levels the charge as the scoop is withdrawn. The action is perfect; and the absence of mechanism reduces the risk of stoppage to a minimum. The drawing-machine I consider almost perfection; and in works where charging machines—which necessitate the use of coal breakers and elevators—could not be conveniently employed, or where the outlay would be too great, the use of a drawing-machine alone would be attended with very good results. The work of drawing a retort is more trying to the men than charging; and if charging alone had to be done, they would readily undertake to do double the number of retorts. Thus fewer men would be required; and the work would be done more expeditiously.

We are about to adopt this arrangement in one of the retort-houses at East Greenwich; and four of Foulis's hydraulic machines, from his latest design, are being constructed for that purpose. When in Glasgow some time ago, I saw these machines at work; and I was much impressed with their performance. Their light weight and absence of complicated parts, place them at a considerable advantage compared with other machines. I am indebted to Mr. Foulis for the drawing on the wall illustrating the machine, which consists of a steel bar of I section marked B, and shown in enlarged cross section at A A, suspended near its centre to a framework of angle-iron marked C. On this bar there slides a carriage D, which is moved backwards and forwards by two hydraulic cylinders, one of which is shown in elevation at E and in cross section at A A. The rake-rod F is attached to this carriage. The bar B, together with its hydraulic cylinders, rake-rod, levers, &c., is raised and lowered to suit the various heights of the retorts by means of the hydraulic cylinder G, fixed to the framework C as shown. A rope or chain shown at H, attached to the suspending rope or chain, passes upwards over the pulleys I, and downwards over the pulleys J; the end of this rope or chain being fixed to a frame K. This frame is connected to the rake-bar by a short crank L; and to the same shaft which carries this crank is attached a crank M, which actuates the valve N, for moving the rake backwards and forwards, and also the handle O. The effect of this arrangement is, first, to maintain the rake-bar at the same horizontal level in all positions; and, secondly, it effects the movements for opening the valve, so as to send the rake into the retorts, to depress the back end of the I bar, and so elevate the rake that it passes over the coke, the reverse movement depressing the rake and withdrawing it from the retort. On the top of the framework is fixed a joint P, so constructed that the flexible supply pipes may be speedily connected thereto without either screws or bolts. From this joint ½-inch pipes are led to the hydraulic cylinders; the connection being made by means of a flexible tube Q, to admit of the rake being raised or lowered. The whole apparatus is controlled from the platform R. The pipe S is perforated at the front end; so as to discharge some of the water on the rake-rod, and so tend to keep it cool. At the front end of the bar B, is attached a plate T, to prevent the coke from being scattered over the floor. When the bottom retorts are so low that there is not room for this plate when drawing these retorts, it is raised automatically by means of the levers and rods U, actuated by the pulley V, moving between the angle-iron bars W. The machine is moved horizontally from one retort to another by means of the handle X, and the bevel wheels and pinions Y and Z. The quantity of water that is used is small—the cylinders being only 1½ inches in diameter. The time occupied in drawing a retort is not more than 35 seconds. At Glasgow, the retorts are set in beds of eight; and the time occupied in drawing the whole bed, including all movements of raising and lowering the rake-bar and moving



FOULIS'S PATENT GAS-RETORT DRAWING MACHINE.

the machine from one retort to another, is not more than from six to eight minutes.

When the West machines were first started, in order that the men might gradually accustom themselves to working the same, only two beds of retorts were operated upon; and this number was gradually increased as the proficiency of the men increased, until the maximum number of fifteen beds was reached, or 150 retorts in all. Six-hour charges are in use, and a draw takes place every two hours; and in order to have a long interval for oiling round and performing any repairs that may become necessary, I have so arranged the work that we have two short draws every twelve hours. Beginning at six in the morning, the two top rows, consisting of 60 retorts, are drawn and charged, occupying one hour. At eight the next two rows are drawn; and as a portion of coke from these two rows is drawn direct into the furnaces, about fifteen minutes extra is taken. At ten, the bottom row is drawn, and this takes about half-an-hour; thus leaving an interval of 1½ hours before the next draw at twelve. The last draw of the day, at 4 p.m., is also a short one; and the men are enabled to wash and dress and leave the works before five—so that the so-called twelve-hour day is in reality only eleven hours, and six of these are spent in idleness. I may say the same thing applies to the hand work; it is arranged in the same manner.

The coal as delivered from the ship is brought into the stores and deposited directly over the breakers, and is conveyed by elevators into fixed hoppers in the centre of the section, holding about 6 tons each. The hoppers attached to the machines contain about 2 tons 10 cwt.—sufficient to charge fifteen retorts—and have to be refilled from main hoppers when half-way along the row. These main hoppers are two in number, one on each side of the retort-beds; and in the centre of the bench, the elevators which supply them are in combination with the coal-breakers and driven by a 9-horse power "Otto" gas-engine to each. Gas-engines were introduced owing to our boilers being situated a long distance from the retort-houses, necessitating such a length of steam-pipe that would result in considerable loss by condensation. The results of the employment of gas-engines are in every way satisfactory; and the amount of gas required averages 20 feet per ton of coal broken and lifted, and the engines are frequently running when no coal is being lifted. The breaking is not a serious matter with us, as most of our coal is dust before it arrives. The weight of charge per mouthpiece is about 3¼ cwt., or 210 tons per 24 hours for the 300 mouthpieces.

The detailed cost for labour of carbonizing, and also cost of maintenance of machinery, is given in the subjoined tables, which give the number of men required in the 24 hours, their rates of pay, and the cost of labour and material for repairs and maintenance. As I am instituting a comparison between hand and machine work, I am leaving out firemen, coke-wheelers, and those men who are common to the two systems.

MACHINE WORK.

Cost of Labour per Day.

8	machine drivers	at 6s. 9d.	£2	14 0
4	opening doors	at 6s. 0d.	1	4 0
4	shutting doors	at 6s. 0d.	1	4 0
8	furnace fillers	at 5s. 6d.	2	4 0
2	gas-engine drivers	at 6s. 0d.	0	12 0
2	greasers	at 5s. 0d.	0	10 0
28		210 tons at 9·6d. =	£8	8 0

Cost of Maintenance and Repairs per week.

Oil and waste		£3	0 0
Belts and laces (average)		1	0 0
Gas for gas-engines (cost price)		3	15 0
Wages for repairs		2	10 0
Sundries		1	15 0
	1365 tons at 2·1d. =	£12	0 0
	Labour	9·6	
		11·7d.	

In the same number of retorts worked by hand, about 3¼ cwt. is put in per charge per mouthpiece, equal to 200 tons per day. The cost of carbonizing this is as follows:—

HAND WORK.

Cost of Labour per Day.

12	scoop-drivers	at 6s. 9d.	£4	1 0
24	stokers	at 6s. 6d.	7	16 0
12	trolleymen	at 5s. 6d.	3	6 0
12	furnace fillers	at 5s. 6d.	3	6 0
60		200 tons at 22·15d. =	£18	9 0

Add to this maintenance 0·75

Giving a total cost of . 22·90d.
Against. . 11·70d. for machine work,

Or a saving of. . 11·20d. for every ton of coal carbonized by machinery.

Allowing for the machinery to be out of action for three months every year, for necessary repairs to retorts, &c., a sum of 1¼d. per ton would pay 5 per cent. interest on outlay; and this would leave a net saving of 9·7d. per ton. The rate of pay given may seem high, as in fact it is; but when the eight-hour system was introduced no reduction of pay was made—80 retorts being done for 5s. 4d. stokers and 5s. 7d. scoop-drivers.

I was not long in coming to the conclusion that the promised advantages to the Company in the increased efficiency of the men, due to the contemplated elevation of their moral tone, which we were led to believe was the necessary outcome of short hours, was a myth and without any substantial foundation. Instead of an improvement, the reverse was the case; and at the risk of offending our friends of the Gas Stokers' Union, I offered a proportionate increase in wages for 100 retorts to be done per shift on the two-shift system. Plenty of men were forthcoming anxious to earn the extra money, and all the work is now done in two shifts; and I am convinced that it is better for the men and better for the work.

It is well known that, for facility of working machine-stokers, certain rules must be observed as to size and shape of mouthpieces; and another important point that must not be lost sight of in the general arrangements is the position of the mouth of the furnace for automatic feeding with hot coke as drawn from the retorts, and the provision of means for directing it into the furnace. On account of the speed of the rake, and the quantity drawn out at each stroke, this is not so easy of attainment as might appear at first sight—especially with inside producers, as in use at East Greenwich, the coke having to be directed backwards after being pulled forward by the force of the rake.

Different forms of hoppers and shoots were devised; but they either got choked with the fuel, or allowed most of it to fall on to the floor below. At that time we were drawing the retorts in succession, and there appeared to be no practicable solution of the difficulty; as in moving from one retort to another, the position of the shoot had to be altered at each retort, which was difficult of attainment. We then decided to draw the right-hand retorts in each bed first, traversing the row a second time for the left-hand retorts. The question of feeding the furnaces was thus solved, one position of the shoot serving for all the right-hand retorts; and on arriving at the end of the row, the shoot was unhooked and reversed, being then in a position for the left-hand retorts. Two curved plates are riveted to the front of the machine at two different points, one of which is always opposite the furnace mouth whichever retort is being drawn. The moveable shoot is hooked on to the machine just under the retort to be drawn, and the lower end rests upon one of the fixed curved plates. A man standing on the machine with a long rod pushes the coke back into the furnace as it falls on to this plate; and the furnace is thus completely filled. With an outside producer, the operation would be more simple, as the coke would fall directly into it. When the furnace is filled, the mouth is sealed with two shovelfuls of wet breeze rammed hard, and a loose fitting cast-iron cover put over it. This wet breeze soon becomes hard, and hangs in position when the fuel has burnt away from it; and at the end of six hours, when the furnace has to be refilled, it generally requires considerable force to remove it.

The case for machine stoking is not completed with a statement of the amount of reduction in the carbonizing wages. The subject of stopped pipes is always one of interest to gas managers; and a suggestion for the prevention of the evil is always eagerly investigated by those who are troubled with the complaint. The primary cause of stopped pipes is irregular or insufficient charging, together with irregular heating. If the middle of a through retort is at a proper temperature, and a due proportion of the charge is not deposited there, a stopped pipe is the almost inevitable result; or if a smaller charge than the retort is capable of dealing with is put in, a like result may be anticipated. Both these conditions are easy of attainment under the hand system of charging; it being impossible to exercise supervision over each charge, and the men being anxious to get their allotted task over as quickly as possible, it is frequently performed in a slovenly manner.

With the introduction of machinery, an entirely new state of things obtains. It becomes as easy to put in a full charge as a light one, and the driver cannot turn the scoop until it is right home in the retort; and thus a proper charge is guaranteed. The effect of this has been to greatly diminish the number of stopped pipes, and must be placed to the credit of machine stoking. In addition, greater regularity in the illuminating power is maintained—no inconsiderable gain to those of us upon whom devolves the duty of meeting the exacting requirements of the guardians of the public with their improved photometers and candles, constantly endeavouring to commit us for a deficiency of one or two decimal points in the value of the light given. Another point is gained by having the retorts open a much shorter time than is usual with hand work, which has an undoubted effect upon the yield of gas. A further saving in the matter of coal-wheelers is effected by means of the elevators, which enable us to dispense with all wheeling on the stage. The figures were not given in the comparison, as the cost varies from time to time according to circumstances. When a ship is being discharged, the coal is dropped directly into the breakers, and at other times it has to be wheeled from the store; but the saving under this head is certainly not less than 1½d. per ton.

Having described the advantages of the employment of mechanical stoking, I may be permitted to point out a possible source of loss that may result. Having it in our power, by the employment of machinery, to greatly increase the amount of coal put into a retort, and being enabled with improved furnaces to increase the heat to the extent required for burning off the

charge, it would naturally seem to be an all-round advantage to load the retort to its fullest capacity, as no more wages would be paid to put in 4 cwt. than would be paid for 3 cwt.; no extra labour being required for the purpose. But I am of opinion, and my experience confirms it, that there is a limit to the charge beyond which it becomes positively wasteful, although the larger amount may appear to be well carbonized. It is no new thing to hear of a decreased make per ton following upon the introduction of machinery; or a deficiency in the coal when the stock is worked out where the coal is not weighed into the retorts. I would suggest that this arises from the fact that, with a thick layer of coal in a retort, the conditions for efficient carbonization are absent; and although the charge may appear to be thoroughly burnt off, it is open to question whether the same amount of permanent gas is produced per ton as would be evolved by a thinner layer with a lower heat. Acting on this idea, I some time since reduced the charge and lowered the heats, and am confident that a larger make per ton resulted. Smaller charges of shorter duration would probably be better; but there are practical difficulties in the way. Another source of loss appears to me to exist by reason of the necessity for more frequent scurfing of the retorts when machinery is employed. A very small amount of carbon is sufficient to impede the entrance of the rakes and scoops, which are larger than those used in hand work; and the process of scurfing, however carefully it may be performed, is injurious to the retorts besides necessitating their remaining out of action during the time, and causing a leakage after the operation till they have again become scurfed over.

Any paper on the subject of mechanical stoking would be incomplete without a reference to its bearing upon the labour question. In the present state of affairs, anything that tends to minimize the effect of a combination amongst workmen for the attainment of certain objects, regardless of the results to their employers, which is the form usually taken by these outbursts, is worthy of the fullest consideration; and my own feeling is that a justification for the employment of machines, even if no economy could be shown, would be found in the fact that the prevailing disposition on the part of the men would be held in check. It would, perhaps, be difficult to convince the average working man that the introduction of machinery whereby fewer men are required is no menace to him; but I think it can be clearly shown that such is the case. If by improved methods of working, gas can be produced at a less cost, it follows that a lower price will be charged for it; and if previous experience is worth anything, this means that more gas will be used, necessitating an extension of plant and the employment of additional hands in every department of the works. In view of the undoubted economy that can be effected, those who wish to move with the times cannot ignore the claims of machinery for performing the most important of the operations of a gas-works.

Discussion.

Mr. J. West (Manchester) said there were a few figures in Mr. Tysoe's paper to which he should like to call attention. Mr. Tysoe had laid before the members the cost of machinery in comparison with hand labour; and he showed that the figure was £8 8s. by the machine working on fifteen settings of retorts, or rather 300 mouthpieces, and by hand £18 9s. With hand work he carbonized 200 tons per day; and with the machinery, 210 tons. Then he said he had only taken those men who were absolutely connected with the machinery—those who worked on the stage. He (Mr. West) thought that Mr. Tysoe's own figures went to show that the men below had something to do with the matter. There were an additional 10 tons of coal carbonized by the machine than by hand labour; but he was not aware whether Mr. Tysoe paid his firemen and cokemen any less on the 210 tons than on the 200 tons. The most accurate way of giving statistics of this kind was to take all the men working on the old system before machinery was adopted, and after the machinery had been introduced. Mr. Tysoe made the cost of working by hand 22·15d. per ton, and by machinery, 9·6d. per ton. If he (Mr. West) was correct in taking the firemen and also the cokemen into the calculation, he made the cost by machinery 13·97d. per ton, and by hand work 28·17d. Taking Mr. Tysoe's figures, the saving in working by machinery on the total quantity of coal carbonized was £10 1s.; and by his (Mr. West's) method of calculation £11 5s. There was, however, a much more important matter than that. Mr. Tysoe had been working the machinery on fifteen beds, or 300 retorts; and he told them that it was capable of doing more work, and that more would eventually be done by it. At present these machines were only doing 75 per cent. of the work they were able to do, or that had been done by them in other places. At Beckton, working on the twelve-hour system, the number of retorts charged per pair of machines was 360 per day, and at Manchester, from 360 to 420. At the Whitwood Chemical Works, they were drawing and charging, with 12-hour shifts, from 375 to 390 retorts. He calculated that Mr. Tysoe's pair of machines would be fully capable of working eighteen beds, which would make the same number of retorts as at Beckton. The men that Mr. Tysoe had down in his paper for the fifteen beds would be employed for the eighteen beds—in fact, there were two more men there than were found to be working at other places. This probably arose from the retorts being five tiers in height. If they adopted Mr. Tysoe's way of reckoning, and only took the men on the stage, the eighteen beds of retorts would bring up the total amount of coal to 252 tons, to 240 tons by hand. They would find this would make a great deal of difference indeed. For instance, with the £8 8s., he would be able to carbonize 252 tons, which would reduce the cost to 8d. per ton, instead of 9·6d. At present the hand work on fifteen beds cost £23 9s. 6d. To this Mr. Tysoe would have to add one-fifth for the three extra beds, which would make the cost £28 3s. 4d., and would carbonize 240 tons of coal; while the cost of machinery would be the same, and yet more coal would be carbonized. If they took all the men, which he contended was the best plan, it would cost by machinery, with the firemen and cokemen, £12 4s. 6d. for the 252 tons, which would be 11·64d. per ton. But if they added one-fifth to Mr. Tysoe's amount for carbonizing the 240 tons, it would come to 28·16d. per ton, which gave a difference (that is a saving) of 16·52d. The cost for hand work would be 28·16d. per ton; and adding to that ·75d. for wear and tear, it would bring the total cost of the hand labour to 28·91d. To the 11·64d., it would be necessary to add the interest and the wear and tear to the other expenses which Mr. Tysoe had enumerated, which amounted to 3·6d. This brought the saving by machinery to 13·67d. per ton. They must add 1½d. for the coal breaking and conveying; and this made the total saving (say) 1s. 3d. per ton, which he thought was a fair figure. Mr. Tysoe had also told them that there was an increased make per ton of coal carbonized when machinery was employed. This was the universal experience. It was found that the machinery distributed the coal in the retorts more evenly; and by this means a larger volume of gas per ton of coal carbonized was obtained. Besides this there was a reduction in the number of stopped ascension-pipes; and he wished to point out that something should be taken into consideration for these advantages, It was not a small matter, with a bench of eighteen beds, or 330 retorts, to be able to make 750,000 cubic feet more gas per week than by hand power; and this was how it worked out according to Mr. Tysoe's showing. Another advantage was that, where they worked on Sundays, the number of men required was reduced. He thought if they put all these advantages together, the saving by machinery at the East Greenwich works would amount to about 1s. 6d. per ton. There was another question. It was necessary to take into account that, where regenerator furnaces were in operation, there was no reason why they should not go on working continuously, until the furnaces or something else gave way. Those machines had been at work now for eight months at East Greenwich; and they would go on for three or four months longer without stopping—indeed, he had worked machinery for more than eighteen months. He might add that the machines Mr. Tysoe had described, which only worked at present one-third of the retort-house, were capable of dealing with from 65,000 to 85,000 tons of coal per annum. Now if they simply took the gain at 1s. per ton, it would not be a small matter. It was possible, in fact, to work the machinery to such an extent that it could be almost paid for in one year.

Mr. T. May (Richmond) remarked that at his works they had West's hand-power machines in use; and they found them of great benefit. He might say that his experience was that, with these hand-machines, there was a saving certainly, after allowing for interest on wear and tear, of 10d. per ton of coals. In addition to this, Mr. Tysoe had mentioned other advantages; and there was no doubt there was a reduction of stopped pipes, and an increased make of gas per ton of coal. At Richmond, they easily made 11,000 cubic feet of gas per ton, working with coal which, in many other works, did not very often yield so much by 1000 feet. This was a point which he thought should be made more of in estimating the value of these machines.

Mr. W. A. Valon (Ramsgate) said he could also personally speak as to the benefit derived by the use of West's hand-power machines. They had them at Ramsgate; and they were perhaps one of the first in England to adopt them. They had had the machines in use a great number of years, with, consistent results; the saving having been from 1s. 1d. to 1s. 3d. per ton throughout the whole time. The wear and tear of the machines was very low; and he need not say that the amount of skill necessary to work them was exceedingly small. He was glad to find that the question of machinery was coming to the front so rapidly as it was. He was quite sure it was a move in the right direction. They ought to have gone into it with more courage and determination a good many years ago; and they might then have had some answer to the agitation they had had to meet—in some instances of a very embarrassing character. He had in past years often spoken to engineers on the subject of stoking-machines, and in many cases they had said: "We can do the work by hand labour as cheaply as by machinery, and therefore we do not see the advantage of going to the outlay." He could not convince them that the outlay for machinery would be covered, and the same results obtained; their only reply being that they could not get better results with machinery than they already obtained. He did not think that this was any answer to the question now; for they all saw the importance of having something more to fall back upon than the bone and muscle of the old days.

Mr. Charles Gandon (Lower Sydenham) said they had in use, in one of the retort-houses at his works, Mr. West's compressed air-machinery; and, so far, they had found it work very satisfactorily. As to the financial aspect of the question, he could not speak so enthusiastically as Mr. West had just done.

There was no doubt it required less stokers than under the old system; but when they came to count up the number of hands they had about looking after the machinery and so forth, the economy in his case in the amount of labour did not come out nearly so large as others had experienced. This was perhaps partly their own fault, because they had a stage house, and the coke was drawn out of the retorts on to the stage, and this interfered with the action of the machinery. He was now trying an arrangement to take the coke away by means of a conveyor and elevator; and if this was successful, he had no doubt they would find the machinery work very much better than at present. When they first used the machines, they found considerable difficulty with them on account of breakdowns. These accidents always happened at the worst time—in the middle of the night, or when they were very busy—and this caused them great inconvenience. Since then, however, Mr. West had made some slight alterations; and he must say that they now experienced very little trouble. He agreed with Mr. Valon that, apart from the question of economy, it was very desirable that they should turn their attention to the introduction of machinery, with the object, if possible, of rendering themselves less dependent upon manual labour.

Mr. Frank Livesey (London) said that Mr. Tysoe had dealt so fully with this subject of stoking-machines, that he had very little to say. He might mention, however, that when Mr. Tysoe was working entirely with machinery, the carbonizing wages were very satisfactory indeed; but they were not so now. He meant by this that the results showed better when the whole of the work was done by machines than it did now with only one-third of it. As Mr. West was present, he should like to say that the machine was a very heavy one; but this was probably due to the fact that it had to reach five retorts set one above the other, instead of three, which entailed having a heavy framework and large foundations. He thought that, if Mr. West turned his attention to this point, he might be able to make a lighter machine, and then possibly a cheaper one. If they looked at the drawing of Mr. Foulis's machine, they would see it had not such a heavy framework. It was exceedingly light, was well constructed, and everything was put in its proper place; but, of course, Mr. West's was a self-propelling machine, and therefore must necessarily carry more gearing.

Mr. Robert Morton (London) said he wished to draw attention to a portion of the paper which had not been referred to in the discussion—that was, with reference to the new scoop which Mr. Tysoe had described. There was no doubt at all that a great amount of gearing was required in turning the scoop of Mr. West's machine first to the one side and then to the other, but he did not know that there was very much against it. When at work, too, the noise made by that part of the machine was, in his opinion, almost more than that of all the other parts put together; and there must consequently be a considerable amount of wear and tear upon it. The scoop that Mr. Tysoe had devised seemed to be of very simple construction; and he was satisfied that it would work satisfactorily. If he understood rightly, the scoop had to go into the retort twice; but it did away with those two motions—going first to the one side, and then to the other.

Mr. Tysoe: The scoop has to go into the retort twice.

Mr. Morton remarked that he did not know there was any necessity for it to go in twice. It appeared to him that Mr. Tysoe might be able to make one large enough to complete the charge in one operation. The means of actuating the bottom were automatic, and did not entail any amount of skill on the part of the driver—it was a purely mechanical thing.

Mr. W. D. Child (Romford) said he should like to obtain a little information on one point. He believed that Mr. Tysoe stated that, with the machine-stokers, the retorts required scurfing more often than when charged by hand labour. He had been under the impression that the use of the machines to some extent did away with this—that there was a sort of scraping action of the charger which kept the retort practically clear of carbon as the work went on.

Mr. West remarked that the working of the rake and the scoop did keep the retort nearly free from carbon. As to Mr. Tysoe's scoop, it appeared that his ideas had fallen in the same direction as his (the speaker's) had done many years ago. He had the same kind of scoop at work at Richmond and elsewhere ten or twelve years since. It was a very simple thing; but it was not successful, as he could not get the coal up to the sides of the retorts or in sufficient quantities.

The President said he must congratulate the members on the interesting discussion they had had, and also Mr. Tysoe upon having been able to place before the members such an instructive and useful paper. In connection with this subject, he said there was one feature which should be borne in mind. Mr. West had pointed out to them the necessity, before these machines were introduced into a retort-house, of seeing that they had the house of sufficient length to develop fully the power of the machine. He took it that it was not every gas manager who had facilities for placing machines of the kind referred to by the author in a retort-house where their power would be developed to the extent it ought to be. Mr. Gandon appeared to labour under this difficulty with his installation.

Mr. Gandon: Our machinery is fully occupied,

The President said he was not aware of that; but it was very different in the case of Mr. Tysoe at East Greenwich. The machines there could be employed for a greater number of beds; but whether or not Mr. Tysoe had these at his command, he did not know. However, it substantiated the fact that, unless these machines were placed before a sufficient amount of work, the benefit from their use would be materially marred. He might say that the other day he made inquiries as to the behaviour of the machines which Mr. West had erected at Beckton; and he was pleased to report that they were working in a very satisfactory manner. He must express his surprise that it should be thought that, by the use of stoking-machines, the formation of carbon in the retorts was greater than in those charged by hand labour. His experience during a considerable number of years of active work in the retort-house had been that, if there was a large formation of carbon in the retorts, the primary cause of it was due to thin charges of coal. The scoops of stoking-machines were designed to hold a certain quantity of coal, which would fill up the retorts; and if they were properly filled, there was a less amount of scurfing required in them than in the case of those improperly charged. He thought that there was one thing in the paper which had been overlooked—he referred to the wear and tear of the machine. Mr. Tysoe had given them some figures which represented the weekly amount expended for oil and tallow and repairs. The repairs, he saw, were put down at something like £2 a week; but probably that represented the attendance of one man. When they paid a stoker for a day's work, they gave him so much money; and this covered all the wear and tear of the stoker. He might work for thirty or forty years; but that had nothing to do with them. In his opinion, there was not sufficient put down in the paper for the wear and tear of the machines. No one could doubt that the durability of a machine, working in the dust and the clouds of steam in a retort-house, was limited; and some consideration ought to be given to that. He wished to lay particular emphasis on this matter, because it was, to his mind, of vital importance. They had a competitor to the schemes of mechanical stoking in the system of inclined retorts. He recently had the pleasure of witnessing at work at Brentford some of the latest adaptations of Mr. Morris's ingenious mind. He had succeeded in charging, with a comparatively small amount of machinery, retorts fixed at an angle of 32°; and he (the President) might say that the charging and drawing of those retorts impressed him very favourably indeed. It was only necessary for him to say that, if it was possible to charge retorts satisfactorily by gravitation (he would not admit that it was done, but he would admit, after what he saw at Brentford, that it was possible for it to be done), then what was the use of introducing stoking machinery at all? There was another point he wished to refer to. It had been stated that the use of these machines was economical in the matter of the coal supply on the stage. He thought there was some little mistake about this. In works where they had an overhead railway, the coals were tipped or shot out of the waggons, and deposited on the stage within easy reach of the stokers. But with machinery, it was necessary to have fixed coal-breakers, which was an additional charge; and, having to put the coal into a breaker and elevator, could not be called an advantage over the old system. As to the introduction of machinery generally, those managers who had charge of works of any magnitude must realize the fact that it would be an advantage to the working man if his arduous labour was superseded by machinery; and in smaller works undoubtedly there would be a great saving by the use of manual machines.

Mr. Tysoe, in reply, said that Mr. West in his remarks criticized his system of making the comparison of cost. Perhaps Mr. West's was the better way; but it simply meant an extra 10 tons of coal per day, which would be a saving, together with the coke. He quite agreed with Mr. West that they could do more work with the machines, and they meant to do more, but they were not at present in a position to do it. They had other beds of retorts at the side of the section that was being worked by the machines. But unfortunately the retorts were much smaller in diameter; and they could not get the scoops in without danger to them and the machinery. He was proposing, however, to put on three more beds, which, he hoped, would make the amount of saving considerably more. Mr. West had also spoken about his (Mr. Tysoe's) scoop. When he made an application for a patent for this scoop, he was told it had been patened by Mr. West something like 17 years ago—in fact, it was described in almost identical words to those which he had intended to use. There was one difference. Mr. West's scoop was only half the length of this one. In Mr. West's original machine, he had a carrier or charger run first into the back end of the retort. Then he withdrew it, and ran it into the front end; and this arrangement was applied to the charger. As to Mr. Livesey's remarks, he had no doubt that Mr. West would be able to reduce the weight of the machines. There seemed to have been a little misapprehension with regard to his observation as to scurfing. What he said was this, that it was necessary to remove the carbon more frequently when machines were employed, and for this reason: That, unless the retort was kept exceedingly clear of carbon, they ran the risk of jamming the scoop in the retort. With regard to the question of wear and tear, he presumed that the President meant that nothing was set down in the paper for depreciation. This was a point he did not deal with; and it would, of course, to some extent modify his figures. He might say that, if he had been the inventor of a machine, he would

possibly have made the figures show a larger saving; but as he was not, he preferred to be well within the margin, as some day he might be called upon to substantiate them. The President had also said something about sloping retorts doing away with machinery; but, as far as he could see, there was as much machinery used with them as with ordinary retorts. In conclusion, he ventured to hope that his paper and the discussion would result in the extended use of machines in retort-houses.

On the motion of the President, seconded by Mr. W. E. Price (Hampton Wick), a vote of thanks was passed to Mr. Tysoe for his paper.

Mr. R. Herring (Dover) then read the following paper, entitled—

A RAPID METHOD FOR INCREASING THE YIELD OF GAS FROM ORDINARY RETORT-SETTINGS.

Of late years, numerous mechanical aids have been designed for cheapening the production of illuminating gas; but the majority of these are minus two important essentials—viz., reliability and simplicity. Some of the systems, also, necessitate such expensive structural alterations as to retard their general adoption. Therefore, if there is any economical and reliable method of improving results *without* structural alterations being made, more will be found willing to utilize it, in preference to the complicated and costly ones recently introduced.

With this end in view, I have been working for nearly twelve months; and after numerous tests (experimentally and practically), I have ascertained that, with the addition of oil compressed and finely sprayed into the retorts (as will be described), more gas is produced than can be obtained from coal alone. In addition to this increase, other advantages are derived, to which your attention will be directed presently.

Before entering into details or describing the apparatus, a few facts relating to my early experience with mixed charges of coal and oil, will account for my later proceedings. About two years ago, I commenced experimenting with these mixed charges; but I was at the time unacquainted with any method by which *oils* could be economically and successfully used in the retort-house, either as a *mixed* charge or as a *substitute* for cannel coal. The following fact will show how the subject was brought under my notice. When appointed to the management of the Dover Gas-Works, I found a considerable quantity of crude naphtha in stock, which had been accumulating for years; and as tar was frequently boiled for asphalte, &c., the quantity increased. Being unable to sell it, I decided to use some in the retort-house, and commenced as follows: Having procured a sound iron barrow, it was partially filled with small and dusty coal, to which naphtha was added until the whole mass was thoroughly saturated. This mixture was used in various ways for fixed periods; and from close personal observation, I ascertained that when a small quantity was thrown to the middle of the retort just before the charge of coal went in, it gave the best results, which far exceeded my expectations. After a few weeks working thus, the remaining naphtha was substituted for cannel coal. Afterwards, tar-oil and various grades of paraffins were used in the same way as enrichers. This method was worked for about six months. The specific gravity of naphtha was ·980.

During this time, experiments with oils under pressure were carried on; and the improved results from this were at once apparent, convincing me that when this system was perfected, it would be successful. Practical working has since proved this. The oils were compressed to a pressure of 25 to 30 lbs. per square inch; and, by means of the injector, sprayed over the charge of coal or coke, with the retort-lid shut. But before this could be tested in the retort-house, a suitable apparatus was required. Therefore, with as little delay as possible, a machine was constructed on the works, at the commencement of the present year, and is still working.

I now discontinued mixing oil with the coal, and proceeded as follows: (1) Ascertained the pressure that would be required to spray oil into the centre of the settings. (2) Selected any retorts that had been working for five hours (previously charged with coal in the ordinary way). (3) Sprayed the oil over the hot coke, and continued at short intervals for six consecutive hours. Coal alone 5 hours; coal and oil, 6 hours—total 11 hours. The remaining hour is allowed to complete carbonization. The charge is then withdrawn, and the retort recharged with coal only.

Adopting this method, coal was continuously used for eighteen hours, and oil six. The number of retorts thus worked, and the quantity of oil used, depend entirely upon the enrichment required. Spraying compressed oil over the charges with the retort-lid shut, obtain much better results than when the oil is "mixed" with the coal and then put into the retort with either scoop or shovel.

With slight modifications, this system was regularly worked for about three months; but owing to the decreased production of coke, I was compelled to make further alterations, which resulted in the method now in use at the Dover Gas-Works—viz., spraying compressed oil on a full charge of coal. The *make* of gas is increased and enriched; and the maximum quantity of coke is produced. This result is obtained thus: Select retorts, charged with the usual weight of coal in the ordinary way. Allow this to remain 2 hours, then spray compressed oil over it. Repeat this spraying at short intervals for 3½ hours. The remaining half hour, *no* oil to be used. At the end of the sixth hour, withdraw the charge, and repeat the operation. From this you will observe the 24 hours are made up as follows: Mixed charge of coal and oil, 14 hours; coal only, 8 hours; 2 hours to complete carbonization—half hour to each charge. *Example.*—In the retort-house, each gallon of oil yields 85 to 90 cubic feet. I will now show how an increase of 5 per cent. in *quantity* is obtained on an estimated make of 10,500 cubic feet per ton. The oil required will be 6 gallons per ton of coal used, in equal proportions in each draw. This, at 87½ cubic feet per gallon, will produce 525 cubic feet, or 5 per cent. Should a rapid increase be required (say, during the period of greatest consumption, &c.), supply more oil—5 to 7 gallons an hour can be safely dealt with.

We will now direct our attention to some of the advantages connected with this mode of working. Gas can be enriched more economically and rapidly than with cannel coal at its present price; and as this enriching can be carried on till within half-an-hour of shutting down, it is very useful at Sunday or other stoppages, as the necessary illuminating power can be maintained to the end. By spraying compressed oil *over* the charge with the retort-lid shut, more gas can be produced than from coal alone, thus increasing the carbonizing power of ordinary retorts. The maximum quantity of best coke is produced. The make of gas can be instantly increased, thereby benefiting any who are compelled to work with limited storeage.

The machine now working at Dover consists of a small reservoir, to which is attached a force pump. The delivery-pipe is fitted with a pressure-gauge, and communicating with a vessel in which the oil is compressed. To this is attached one or more flexible hose-pipes, long enough to reach over one bed of retorts, and terminating in the sprayer. The whole is mounted on a light carriage. In addition to this apparatus, ordinary ¾-inch iron cocks are fitted to the retort lids, and in such a position as to permit of the oil passing clear over the charge, upon which it will fall in the form of spray. If single retorts be used, the oil should strike the back; if throughs, it should just pass the centre; and in no case ought it to fall nearer than 5 feet from the mouthpiece. With this machine, 55 gallons of oil per hour can be sprayed; and this, working nine hours per day, will produce about 43,000 cubic feet of gas.

From these details, you will observe that the special appliances required for this process are few and inexpensive; and also that during nine months use I have found them reliable and easily worked. Up to the present time, low pressure has been used—about 25 to 30 lbs. per square inch; but in future we shall use high compression, by which the expansion after passing the sprayer will be considerably increased, and the oil more thoroughly broken up. On no account should oil be forced into retorts in a solid stream, however fine—minute particles give the best results.

In this paper, my experiences are very briefly stated, respecting practical working with mixed charges of coal and oil, as compared with compressed oil, finely sprayed into the retorts, in addition to the usual quantity of coal, by which means an increased yield of gas is rapidly obtained from ordinary retort-settings.

Discussion.

Mr. C. C. Carpenter said he was sure they were all much obliged to Mr. Herring for his paper. There were one or two points upon which it might have been clearer, and upon which he might have given them some information. Not having had a copy of the paper, he (Mr. Carpenter) was not sure whether the results had been obtained by the use of naphtha or some other oil; and he would like to know what was the kind employed. The other point, which was an all-important one, was this: How much gas did he make in the usual way with the ordinary coal; and what was the illuminating power of the gas? Then, what did he consider the proper quantity of oil to use; and what was the increase in the volume of the gas, and in its illuminating power? With regard to the rapidly-increasing yield from ordinary coal, it was not difficult to obtain that with any gas-heated furnace. With such a furnace, one could very quickly increase the make per ton by 10 per cent. Then, with the means of enriching gas now in vogue in London (he referred to Mr. Frank Clark's process, in which oil was used), they could very readily raise the illuminating power to the required standard. This was another and a simple way of obtaining results similar to those realized by Mr. Herring.

Mr. T. May asked whether Mr. Herring had worked out the cost per candle of enriching the gas by the process he had described. In a paper which Mr. Frank Livesey read before the Association last year upon the Clark system, he gave the cost of raising by 1 candle the illuminating power of any ordinary quality of gas; and if Mr. Herring could give them similar information, it would answer Mr. Carpenter's question and his own.

Mr. A. F. Browne (Rotherhithe) said his experience with regard to the injection of oil into retorts had not been very great. He certainly had made some experiments in this direction. Whether it was that he did not try the process on a sufficiently large scale, or whether there was something radically wrong in the system he adopted in getting the oil into the retort, he did not know; but he could not say it was very successful. He injected a large amount of oil into the retorts. He increased the quantity put into each separate retort, and multiplied the number of retorts very considerably; but he was bound to say that, with regard to the increase in illuminating power, on the whole

he was unable to get anything like a satisfactory result at all. At the Carshalton Gas-Works, Mr. Good employed for enriching purposes Russian refined oil of ·825 specific gravity. This was, of course, a cheap oil—much cheaper than the oil used in London, in Mr. Clark's process. It would be very advantageous if they could get the good results which were evidently to be obtained with this cheap oil—Mr. Herring obtained them, so did Mr. Good—but his (Mr. Browne's) experience with it was not a success. He next tried some experiments upon the direct carbonization of oil in separate retorts; and in this direction, he had certainly achieved much greater success. He might say that at the Rotherhithe Gas-Works, the only difficulty was that the number of retorts was insufficient, in consideration of the heavy winter make of gas, to affect the whole bulk of gas to any extent. He was now using this system day by day. In the employment of the Russian refined oil, he thought they had a means of enriching gas which would compare favourably in point of cost with cannel, and also with Mr. Clark's process. The direct manufacture of oil gas, of course, took a certain amount of time; but the injection of the vapourized petroleum into the gas direct could be set in full operation in about five minutes. He could not agree that Mr. Clark's process was so cheap as had been stated. He did not wish to say at the present time what was the cost per candle; but he believed the cost of enriching gas 1 candle—from 16 to 17 candles—by oil gas direct as manufactured in the retorts, was about 2¼d.; but occasionally he should say it would be more like 3d. He was still engaged on some experiments in this direction; but he had not yet had time to complete them. However he could certainly support Mr. Herring's contention that the manufacture of gas from this inexpensive oil was a cheap method of enriching gas.

Mr. J. Somerville said he had been trying oil in various ways, in place of cannel, for the past twelve months or thereabouts. The best arrangement he had employed was to drive the oil into the retort with superheated steam (at about 500°) two hours after the retort had been charged. This sent the oil into the middle of the retort; and he found this was by far the best method he had tried. He had not had any experience with Mr. Herring's plan of compressing the oil; but he thought it might answer. With regard to the question of cost, he found that, to raise the illuminating power of 1000 cubic feet of gas by 1 candle, it cost from 1·12d. to 1·5d.—that was, using Russian oil of ·850 specific gravity, at about 4d. per gallon delivered. At times the results obtained did not suit the gas-testing arrangements; and then they had to use a ·680 spirit, and sometimes naphtha at ·700, not in the same way, but by Clark's process. They did not use cannel at all; but they found that the Russian oil was all that was needed.

Mr. J. W. Helps (Croydon) observed that it was only fair to an absent member to say that the arrangement which had been described by Mr. Herring had been at work at Carshalton for some few years past; the only difference being that, instead of compressing the oil in a reservoir, and then conducting it to the retort, it was taken to the retort and compressed in a sort of syringe, and forced into the retort in the form of spray. He (Mr. Helps) made some tests two or three years ago, to see what amount of enrichment was put into the gas; but he was unable to get any particulars as to the exact quantity of oil then being employed, or as to the increase in the illuminating power of the gas. The quantity of oil that was being used increased the illuminating power by 1½ candles; and this seemed to be carried a considerable distance into the town.

Mr. J. Davis (Gravesend) asked whether Mr. Herring had any difficulty in converting the oil into a permanent gas.

Mr. F. D. Marshall (Copenhagen) said that a few years ago he tried a process of enriching gas which he patented in 1876 or 1877; but in that he used superheated steam. The oil was injected into the retort; but they experienced great difficulty, as they could not get it fixed. Afterwards they passed the gas from the lower retort through the mouthpiece into another retort; and they found, by that means, they were able to fix it. The process, however, was far too expensive. It cost them 16s. per 1000 cubic feet, taking into consideration the amount of coke required for carbonizing the oil. He thought that to inject the oil into the retort was a mistake; and, in his opinion, it should be submitted to carbonization in separate apparatus. He had spoken on this subject to the Engineer of the gas-works at St. Petersburg, where, as the members knew, oil was almost a drug. Even with the low temperature there, the Engineer said he had no difficulty in fixing the gas. He told him that, in order to fix it, he carried it through a series of heated tubes; and he then injected the oil into the beginning of the condenser, and by that means he was able to maintain a fairly high illuminating power—in fact, as far as he could see, there was no deterioration whatever.

The President said it seemed to him that this matter had been put before them in two lights. They had conflicting statements in the discussion, which must have some meaning; and he would venture to give an explanation of the cause of it. In his experience of using oil as an enricher, he had arrived at this conclusion: That before they could do anything with it, in the first place they had to convert the oil into a permanent gas; and then a suitable conveyor had to be provided. If they were manufacturers of hydrogen pure and simple, without any illuminating power whatever, and they brought it into contact with gas derived by any means from oil, they would have no difficulty in having more than a mechanical mixture. Then the gas would prove permanent and stable; but if they used oil in the way described by the author—carbonizing it in ordinary retorts, and mixing it with illuminating gas—then the difficulty they experienced was to find a proper conveyor or receptacle for those hydrocarbons which they wanted to keep with the ordinary gas. To carburet 15 or 16 candle gas was a very different thing to carburetting 13 or 14 candle gas; and before they could develope the full use of oil, he was convinced that they must make a gas of the old type—say, 14-candle gas—and then carburet it. With regard to the system described by Mr. Herring, he must join with those whose experience had been that it was not a suitable way of enriching gas. He had made some experiments with oils of various specific gravities, and used them in a retort; and he had succeeded—in fact he was determined to make its presence visible in the engine-room; but when it passed through the other apparatus, he could find no trace of it. He might also mention that he had recently proved that, if they wished to use oil of a specific gravity of ·8 or something like that, in the most satisfactory manner, the only way they could do it was by carburetting water gas. In this manner, they obtained from the oil exactly double the value that they would do when using it in an ordinary retort, and carbonizing it as they would coal.

Mr. Herring, in reply, said, with reference to Mr. Carpenter's questions, that the oil he used had a specific gravity of ·825, and was not rectified. The illuminating power of the gas was increased 1½ candles—from 14¼ candles to 15¾. Mr. Browne stated that he did not get good results by injecting oil into his retorts, and that he injected increased quantities. That was where, in his opinion, Mr. Brown did wrong. It was necessary to use the oil in very small quantities indeed—in fact, they could not put into the retort too little at one time. Besides the oil must be compressed; otherwise it would not be broken up.

The President: You compress the oil before it is put into the retort, and you attach importance to that?

Mr. Herring replied that he did. Mr. Davis had asked him whether the gas was permanent. He could only refer him to last winter, when the temperature, he thought, was equal to that of Copenhagen or St. Petersburg; and the gas then remained permanent. Facts went to show that this process effected a considerable saving, owing to the decreased quantity of cannel used, and the increased amount of coke produced. Mr. Good did not compress his oil; he simply put it into the mouthpiece of the retort where it should not go. If the retorts were single ones, the oil should be sent into the back ends; but if they were through retorts, it should fall in the centre. Then in its passage to the ascension-pipe it would become fixed, and made into a gas.

Mr. May asked what it cost to increase the illuminating power of the gas by 1½ candles?

Mr. Herring said he could hardly answer that question; but he could give the members a few interesting figures. He would take a period of four months' working in the years 1888 and 1889 when cannel was used, and the same period of 1891, when oil was employed. In 1888, it cost £136 to enrich the gas from 3337 tons of coal; in 1889, £182, with 3957 tons; and in 1891, £84, with 3954 tons. During these periods, the working conditions and the coal were practically the same; and the illuminating power was raised 1½ candles. If they could enrich gas by any other means than cannel, the value of the coke was at once increased. In his own case, nothing but best caking coal was used; and the best coke was produced. All the retorts were charged with the maximum quantity of coal, and were doing their full work, *plus* the gas produced from the oil.

A vote of thanks was passed to Mr. Herring for his paper; and this concluded the business before the meeting.

The members, with the friends present, afterwards had tea together.

INSTITUTION OF CIVIL ENGINEERS.

The Opening Meeting of the Session.

At the First Ordinary Meeting of the Session, on Tuesday last, the President (Mr. George Berkley) delivered an Inaugural Address on the occasion of occupying the chair for the first time since his election. Choosing for his subject the advance of engineering work in relation to social progress, the President commenced by briefly referring to the social condition of man and engineering work at very early periods. In contrasting ancient with modern conditions, he gave some particulars of the existing works of municipal engineering in Rome. At the present time, he said, water—probably from the same source in the Apennines as that used 1900 years ago—is conveyed to Tivoli partly in masonry pipes and partly in tunnels, and from Tivoli to Rome in cast-iron pipes. This supply amounts to something like 51 million gallons a day. The city is furnished with electric light from dynamos worked by steam power; but it is proposed shortly to supplement this by a current transmitted from Tivoli to Rome, a distance of 18½ miles, at an electrical pressure of 5000 volts. The motive power is derived from a head of 165 feet and a flow of 770 gallons of water per second. The generating-plant consists of six 360-horse

power turbines, each directly coupled to a 300-kilowatt Ganz alternator, and three 50-horse power turbines, coupled to exciters. The current will be conducted through four standard copper cables to a transformer station at Porta Pia, where the pressure will be reduced to 2000 volts. Other important municipal works are in progress with the object of abating the injurious floods to which Rome is subject, and of preventing the direct discharge of the sewage into the Tiber. Resuming the chronological sequence of his subject, the President referred in succession to the great mechanical inventions which have made good the claim of engineering to be considered one of the greatest, if not the chief, factor in social progress. After dwelling upon the revival of inland navigation, and giving particulars of the various ship canals now being constructed in various parts of the world, the President proceeded to consider the railway system of the North American continent. Allusion was then made to the production of iron in the United States; and he concluded by referring to the growing employment of electricity as a source of power in the requirements of modern life—instancing the large use of water power in America for driving dynamos to generate the current; successively touching upon the recent improvements in telegraphy; the general adoption of the telephone; the future of electric lighting; the electric welding of metals; and the transmission of power to great distances. The President summed up all by saying: From the experience of the past, there could be little doubt that engineering had resulted, and would in the future result, from (1) the increasing requirements of mankind, (2) greater scientific knowledge, and (3) the capability of engineers to apply this knowledge for the use and convenience of man.

A NEW DOUBLE-EFFECT PHOTOMETER.

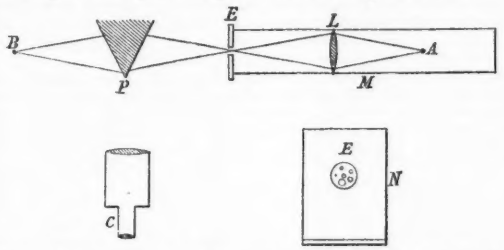
MM. J. B. Baille and C. Ferz have recently contributed to *La Lumière Electrique* some observations upon the photometry of electric arc lamps, and of some other luminous sources. The formula, as they state it, which gives the total quantity of light, Q, received by a surface s, from a luminous surface s^1 placed at a distance D from it, is

$$Q = E\frac{s\,s'}{D^2}\cos\theta\cos\theta'$$

θ and θ^1 being the angles made by the luminous and lighted surfaces with a straight line joining their centres. When equality is obtained between the standard and the unknown source, we have

$$\frac{I}{I'} = \frac{D'^2}{D^2} \text{ with } I = \int s\,D\,E.$$

When the total intensity is to be determined, it is necessary to know the value of E, which represents the luminous power of the source. In apparatus for the projection of light, E is to be increased as much as possible to the sacrifice of s. For other purposes, on the contrary, s ought to be increased, even if E is diminished, by means of ground or opal globes in the case of electric arc lamps, where the excessive brilliancy of the luminous point fatigues the eyes and gives rise to sharp shadows.



The authors suggest a photometer constructed in accordance with the following diagrammatic sketch. This instrument, which is shown in plan, comprises three parts—a prism of white porcelain P, a kind of camera projector M, and an observing telescope C. Light of a fixed and steady source falls from B upon one side of the prism P. The other side of the prism receives a spot of light originating from a standard placed at the point A (say, a carcel lamp), an image of which is projected by the achromatic lens L through an opening in the screen E (shown also in face at N), which is provided with a moveable shutter pierced with holes of different sizes. The rays that pass through any one of the holes form a cone, the base of which appears on its proper side of P as a circular spot of light. This light is then equalized with that from the constant source B by shifting the instrument M with reference to the prism. When this determination has been made for the carcel, the light to be measured is put in its place, and an observation of the same kind repeated, changing the size of the hole at E, and also altering the distance of M from the prism, until equality is once more established upon the latter. Then let s = the area of the hole used for the carcel, and D = the distance of M from the prism with the carcel at A; and let s' and D' = the same factors for the unknown light. Then $Q = E\frac{s}{D^2}$ for the carcel; $Q = E'\frac{s'}{D'^2}$ for the other light, wherefore $\frac{E'}{E} = \frac{D'^2 s}{D^2 s'}$. If we take E, the luminous value of one carcel, as unity, then $E' = \frac{D'^2 s}{D^2 s'}$ = the illuminating power of the unknown light source.

This possibility of obtaining equality of illumination upon a photometrical screen by varying the two elements D and s, or distance and surface, makes the method a very handy one. The area of the holes must, however, be very small—in no case exceeding 2 millimetres. Moreover, the use of the fixed light B (a complete analogue to the tare in the method of double weighing) eliminates several sources of error, and removes the experimental difficulties which result from the employment in any photometrical instrument of two lenses—one for the standard and the other for the light to be measured. The distance between the diaphragm E and the lens being fixed, it is necessary always to put the light A in the same spot, in order to obtain a clear image upon the screen. The light A and the box M are carried upon the same support. The distance D mentioned in the formula is measured from E to the edge of the prism P. The holes in the diaphragm have to be made with great care.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by correspondents.*]

The Board of Trade Memorandum as to Photometers.

SIR,—The Standards Department of the Board of Trade requires the photometer—not merely those parts of it which may perhaps, by a strained construction, be brought within the Acts, but also the burner, minute-clock, disc and disc-box, governor, micrometer-cock, King's gauge and communicator, the sulphuretted hydrogen test, and the box or case belonging to the photometer, if any—to be sent to the Department for verification and stamping, and declines to carry out the verification and stamping *in situ*; thus putting gas companies, especially those situate at a distance, to considerable outlay for the carriage of the instrument, travelling expenses of the company's representative, and agency charges, as well as the Board's fee (£2 15s.). And if a photometer, though in accordance with the statutory requirements, and it may be even a new one, happens to be built up, what alternative is there for the company but to incur the expense of another instrument, or such alterations as will entail a cost of about £100? Let us examine whether these demands of the Department are authorized by the Weights and Measures Acts under which the Department claims to proceed.

The section (29) of the 1878 Act which deals with the stamping of verification on measures and weights, enacts that they "shall be verified and stamped by an *inspector*." By sec. 40, local authorities of counties and boroughs "*shall* provide local standards of measure and weight," and "*shall* provide means . . . for verifying . . . and stamping weights and measures." By sec. 43, every local authority "*shall* appoint a sufficient number of inspectors of weights and measures," &c., and shall (sec. 44) fix "the times and places, *within their jurisdiction*," for verification and stamping; and it is inspectors "who are (sec. 47) authorized to take . . . the fees . . . specified in the fifth schedule" for such acts. Various other sections deal with the powers, liabilities, &c. (secs. 48, 49, &c.), of inspectors. Under the 22 & 23 Vict., cap. 66, to the standards of which the Weights and Measures Acts, 1878 (sec. 66) and 1889 (sec. 15), are to apply, the inspectors are to attend *at the towns* where the gas is consumed with the copies of the models (meters) and stamps.

Passing to the 1889 Act, sec. 1, which deals with the verification of weighing instruments, requires that they shall be "verified and stamped by an inspector of weights and measures;" and "every local authority . . . shall (sec. 9) . . . make, for the guidance of its inspectors, . . . regulations with respect to the procedure to be observed in the verification and stamping of weights and measures and weighing and measuring instruments." Sections 11 and 12 deal with the qualification of inspectors; and sec. 13 authorizes inspectors to take the fees specified by the Act for verification and stamping. What the Board of Trade *is* authorized to do, and that expressly (sec. 10), is to appoint an officer to hold a *local inquiry within the jurisdiction* of any local authority.

If it be said that local inspectors are not competent to verify and stamp photometers, this objection, though it may be an argument against photometers being intended to be included within the Acts, can be no reason for interfering with the provisions made by the Acts for a *local* verification and stamping of such instruments as *do* fall within them. If local authorities do not carry out the provisions of the Acts requiring that they shall provide local standards and inspectors, and fix times and places, how can a gas company be proceeded against for not complying with the Acts; and, *a fortiori*, how can such local authority take proceedings against them, as in some cases they are said to have threatened to do?

For these reasons, I submit that, even if a photometer, or parts of it, come within the Weights and Measures Acts, the Standards Department cannot require that the verification and stamping shall be done otherwise than in the locality; and that, until proper provisions have been made for such stamping, &c., as required by the Acts, a gas company cannot be proceeded against for not having complied with requirements, for the carrying out of which the requisite provisions have not been made.

A BARRISTER-AT-LAW AND GAS DIRECTOR.

Lincoln's Inn, Nov. 11, 1891.

The Metropolitan Water Supply.

SIR,—You kindly inserted a letter of mine on this subject in your JOURNAL about two months ago, in which I referred to the proposal—shall I say the insane proposal?—of some members of the County Council to go to Wales for a supplemental supply of water for the

Metropolis. I pointed out that London already had from the Thames, the Lea, and the New River an abundant supply of *soft* water; and that water of too great a degree of softness had a very solvent effect on lead. I also pointed out how drop-wrist, palsy, and lead colic would prevail if a further supply of such water were obtained.

In your JOURNAL of the 3rd inst., I find that an inquest has been held on a sufferer from lead-poisoning in the neighbourhood of Wakefield, which derives its water supply from the Rishworth Moors, on the Penine range of hills. At the inquest in question, Dr. Stephenson said that during the last two years scarcely a week had passed without a case of lead-poisoning coming under his notice. Surely the County Council would not be permitted, should they get the control of the water supply of the Metropolis, to carry out a scheme at the ratepayers' expense, which would endanger the lives of the millions of people who inhabit that great City in consequence of lead-poisoning which must result. It is true the action of lead on the human frame is not rapid; but it is *very* certain and *very* deadly. Who is to say that the Vyrnwy supply at Liverpool, or the Thirlmere supply at Manchester, will not in time have a similarly deadly effect?

With the example of Sheffield, Leeds, Wakefield, &c., staring us in the face, will either the County Council of London or the City Council of Birmingham venture to spend millions of the ratepayers' money in obtaining a water supply for themselves and their families, which must sooner or later have a deadly effect upon them. Both of these cities may, and probably will acquire in years to come a further supply of water from subterranean sources, to intermix with the large supply of river water which both cities now possess. I have recently been for a most delightful tour through Switzerland and the North of Italy; and I was shocked to see (among the poorer classes especially) the full necks (*goître*), and the yellowish-brown complexions they mostly had; and as they habitually drink mountain water, it was fair to assume that their death-like appearance was mainly due to drinking water impregnated with lead, or to drinking water deficient (as mountain water is) of those chemical compounds which are so necessary to render the water fit for drinking purposes. Our ancestors drank scarcely any water but "well water," or, at all events, water that was in some way or other derived from subterranean sources; and while the Metropolis is surrounded in almost every direction with chalk formations, I can scarcely suppose it possible that *even* Sir Thomas Farrer or Mr. Binnie would venture to pass such water by when the time comes that it is required, and go a couple of hundred miles to get water which must inevitably be impregnated with lead before it had passed through the leaden pipes of the consumer's residence, and certainly before it had got into the stomachs of the members of his household.

Birmingham, Nov. 9, 1891. EDWIN CHESSHIRE, F.R.C.S.

Trade Catalogue.—Messrs. Richmond and Co., Limited, of London and Warrington, have issued a new catalogue of their gas cooking and heating stoves, shop and street lamps, regenerative gas-lamps, and other appliances.

Sale of Debenture Stock in the Bristol Gas Company.—Acting on the instructions of the Directors of the Bristol Gas Company, Messrs. G. Nichols, Son, and Alder will sell by auction at Bristol, on Tuesday, the 1st prox., £20,000 of debenture stock, issued under the Company's new statutory powers.

Food and Cookery Exhibition at the Agricultural Hall.—At this exhibition, which opened last Tuesday and will close on Saturday next, the advantages of gas for culinary purposes are demonstrated every afternoon and evening by lectures and practical lessons given by Mrs. Thwaites and Miss Agnes Kelman.

Improved Retort-Settings at the Cockermouth Gas-Works.—There has just been carried out at the Cockermouth Local Board Gas-Works an improvement in the carbonizing department, by the erection of two settings of retorts, on Mr. G. R. Hislop's regenerative system, in substitution of a stack which had been in use for 35 years. The alteration (which has been carried out in accordance with the plans, and under the supervision of the Manager, Mr. E. W. Smith) will cost about £720; and it is expected to effect ultimately a saving of 25 per cent. The reduced expenditure will be about £100 per annum. The works were recently visited by the members of the Board, on the invitation of the Chairman of the Gas Committee (Mr. R. Mitchell), when great satisfaction was expressed at the way in which the improvements had been carried out. It may be added that, since the gas-works were acquired by the Board, the price of gas has been reduced from 4s. 2d. to 3s. 7d. per 1000 cubic feet to ordinary consumers, and to 3s. 1d. per 1000 cubic feet for cooking and motive power; and meter-rents have been abolished.

Woodhouse and Rawson United, Limited.—The annual general meeting of this Company was held last Friday, at the City Terminus Hotel, E.C. Sir Rawson W. Rawson presided; and, in moving the adoption of the report, he said, excluding the £16,000 brought forward, the total earnings had been £89,000, out of which the Directors had provided for all the current expenses and what they considered a sufficient amount in reduction of the value of their patents. They had paid their debenture interest, and written off £10,500 for extraordinary expenses, some of which might fairly have been distributed over a series of years. Out of the balance of £35,000 they recommended dividends of 15 per cent. upon the ordinary, and 8 per cent. upon the preference shares, which would absorb £30,500. They had been peculiarly affected by the financial crisis, for one branch of their business was to avail themselves of new inventions, to utilize the patents they possessed, and to interest the public in new inventions connected with electricity. But in the past year the public had not been disposed to enter on new undertakings. He then went through the balance-sheet; calling attention to the chief items therein, and to the alterations which had occurred in them during the past year. He said the gross profit had not been so large as that of the previous twelve months; but the circumstances of the two years had been very different. The profit carried to the balance-sheet was £51,439. The Directors proposed to transfer £10,000 to the reserve fund, and to carry forward about £9000. This brought up the reserve on their two years' working to £45,000. The report was adopted.

LEGAL INTELLIGENCE.

COUNTY OF LONDON ASSESSMENT SESSIONS.

Sessions House, Clerkenwell, E.C.—Friday, Nov. 6.

(*Before Sir* P. H. EDLIN, Q.C., *Chairman, and a Bench of Magistrates.*)

The Gaslight and Coke Company's Assessment Appeals.

(*Continued from p.* 854.)

On the resumption of the proceedings to-day,

Mr. *Marshall* continued his evidence in explanation of his valuation. He stated that in the year 1888-9 the Company appropriated for the purpose of dividend, and for payment of interest on borrowed money, £1,055,948; but they actually earned £1,064,166. During the account year, the Company took £1,056,053; but they only earned £781,614. The hypothetical tenant, in determining the rent he might reasonably be expected to pay, taking one year with another, would not be influenced by the amount earned in a period of sudden transition from low to high prices in labour, material, coal, &c., before he could retrieve his position by advancing the price of gas. He would claim to debit the abnormal expenditure against either the reserve fund or the fund mentioned on the previous day. The Company had in certain years earned more than they divided; and in others, they had made up their dividends by resorting to the unappropriated balances. Therefore the hypothetical tenant would be entitled to take not only the account year, but the previous years, in calculating his rent. The next item in the valuation was "rates and taxes actually paid by the Company in 1889-90 (to be deducted afterwards in each parish), £155,864." This made the total amount appropriated by the Company £1,211,913, including rates and taxes. The net amount earned, *minus* rates and taxes, was £734,182. The tenant's share he made £228,915. He assumed that the tenant would enter at Michaelmas, 1889—the worst part of the year. The total working expenses, less bad debts, amounted to £2,389,009. From this he deducted the cost of coals, £1,256,316; and the landlord's renewals, £110,677—leaving £1,023,016 as the tenant's working expenses, exclusive of coal. The tenant would require 4½ months' expenditure to carry on the undertaking, which would be equal to £383,631. Coals he put at £662,500; then he added the labour on residual products, £13,500. He deducted the cash which would be coming in from the residual products, £286,355; the consumers' deposits, £28,300; and the payments for gas between Oct. 1, and Jan. 15, £100,000. These deductions left £644,976. Then he added for stores on hand: Coke, £13,001; tar, ammoniacal liquor, and products, £88,763; sundry stores, £92,000—total, £193,764. The sundry stores really amounted to £137,027; but he considered that one-third of these were landlord's stores, either for renewals or replacements. For instance, the item included £25,000 for fire-bricks and clay retorts, which would be used for renewal of the retorts.

The CHAIRMAN: Some important questions seem to arise upon this matter of repairs. If they are repairs to the hereditament, and are done by the tenant by agreement with the landlord, is the tenant entitled to claim the capital expended in having the materials in readiness, as well as 10 per cent. of the cost of renewals, 5 per cent. interest on that, and then 2½ per cent. afterwards? No doubt they are repairs which have to be considered in estimating rateable value; but are they of such a nature that the tenant is entitled to claim a reduction in respect of the capital involved in having in readiness the tools and materials? I cannot see how that can be so. The first question is: Are they to be comprised in the cost of maintaining the hereditament? Because, if so, they must be included in the estimate of gross value. Then from the gross value the repairs must be deducted. But it is a different question entirely whether or not the tenant should be entitled to keep the materials on his premises, and charge 17½ per cent. profit. However, this will be matter for argument by Counsel.

Examination continued: The next deductions were—Value of Tools, &c. (Messrs. Castle and Vigers's estimate), £106,393; value of meters (also according to Messrs. Castle and Vigers), £243,334; value of stoves (Mr. Jones's estimate), £53,665; balance from contingencies, as fixed by Mr. Jones, £50,000—leaving £1,292,132 (say, £1,300,000) as the amount of capital the tenant would require to carry on the undertaking. He allowed for interest 5 per cent.; profit, 10 per cent.; and risks, 2½ per cent.—in all 17½ per cent., or £227,500. Then he added the interest which the tenant would have to pay to the consumers upon their deposits, 5 per cent. on £28,300, £1415. This made the total share of the hypothetical tenant £228,915. He put down £41,130 as a renewal fund, and £18,000 as an insurance fund. (Differing from Mr. Jones, he considered the life of the buildings to be 60 instead of 50 years; and the life of the mains to be 50 instead of 40 years.) This left the rateable value of the entire undertaking, *plus* rates, £923,872 Of this sum, £355,071 represented indirectly productive, and £568,801 directly productive works. He had treated all the buildings, houses, and works as indirectly productive, as also the mains below 30 inches, because they were more or less tapped for house pipes. The total gas meter and stove rental over the entire undertaking, less bad debts, amounted to £2,334,971. £568,801 was 24·36 per cent., which he considered ought to be applied to the earnings of the mains in each of the parishes. Witness had also prepared an alternative valuation on the basis of the supposition that the tenant, instead of going to either of the two funds mentioned, had recourse to raising the price of gas. He (witness) took 5d. per 1000 feet increase, instead of the 3d. assumed by Mr. Jones, because 3d. would not give the hypothetical tenant what he would be entitled to have under his statutory powers, and would undoubtedly insist on having.

In cross-examination by Mr. LITTLER, witness admitted that, assuming that there was an explosion for which the tenant was liable, and that there resulted proceedings affecting his liability, it would be a tenant's charge to look after those proceedings. He would not admit that, if other companies interfered with the position of mains, not so as to prevent the landlord's hereditament being of the same value, but to inconvenience the tenant in conducting his works, it would be at the charge of the tenant to seek protection. This was a matter for the landlord, because it was the rateable hereditament that was affected.

The CHAIRMAN: Surely it is only reasonable to allow the Company

expenses for the purpose of watching Bills, and appearing by Counsel in Committees. These are small questions in dealing with a Company which spends its millions annually. I do not suppose the Solicitor-General or Mr. Poland will object to the allowance of a reasonable amount of expenditure of this description.

In further cross-examination, witness defended his disallowance of superannuations to officers of the amalgamated Companies. He admitted that amalgamation, by saving cost and putting a stop to competition, had increased the rental value of the whole concern; and it was necessary to the amalgamation that these officers should be paid off. But the tenant in occupation had nothing to do with that.

Mr. LITTLER: Would it not be worth the while of any tenant to pay this sum in each year, so as to secure a monopoly of the business?

Witness: I do not see how it would effect a monopoly. The tenant would take the thing as it exists; he would not go into the past.

Then what becomes of your 2½ per cent.?—That has been accumulated.

But that does not go to the new tenant; it belongs to, and it is kept by, the old tenant?—The same remark applies equally to the landlord's sinking fund.

Your tenant from year to year would not have this reserve fund; if he has come into possession on Jan. 1, when the old tenant has cleared out, he has sold his stoves and taken his profits, which profits included the reserve fund?—No; I look upon the reserve as a fund that can only be used for certain purposes. It is made up of undivided profits; and they have never been rated. In valuing a gas undertaking, you can only take into account exactly what the Company are entitled to appropriate under their Act.

Do you ever look to see whether people are honestly entitled under an Act of Parliament to do what they are doing?—Always. Even in acting for Companies in the Metropolis, when I have found them making more than they were entitled to, I have ignored it, and simply based my valuation on what they were entitled to.

Do you mean that you do not always take the gross receipts? Did you ever not give the true gross receipts in any valuation you have submitted in Court?—I take the gross receipts, and deduct the expenses; and if the profits are more than the tenant can appropriate, I reject them, and simply take as the basis what he can appropriate, and no more.

You assume here that, on a given day, the new tenant will come in and pay for whatever there is on the spot at a valuation. Surely, the money which is in pocket, whether accumulated, distributed, or spent, of the old Company, is as much their property as the residuals and other things?—It is in the nature of a reserve fund.

But it is their property. What claim can the new tenant have to that being handed over to him?—I am not dealing with an outsider as tenant at all; I take the Company as the hypothetical tenant.

Leaving that fund, and going to the reserve fund created by Parliament, that belongs to the landlord, does it not—it is not in the tenant's, charge at all?—I will not admit that it belongs to the landlord; it belongs to the Company in their capacity of landlord and tenant. It is allowed by Parliament for the purpose of equalizing the dividends.

On what principle would you apportion it as between the landlord and tenant?—It would be a difficult matter. If the fund is trenched upon to meet an abnormal expenditure, that would be done in the Company's capacity as tenants.

How much out of every £100 belong to the landlord, and how much to the tenant?—Neither of them could appropriate any portion of it, unless something happened to justify them in doing so.

Supposing a gas explosion occurred which destroyed or damaged the rateable hereditament, whose business is it to put that right?—The landlord's; I have allowed the Company for insurance.

I ask you again, to whom do these undivided profits belong?—To the Company, in their capacity of both landlords and tenants. *Pro tem.*, they belong to the landlord; but he could not appropriate them.

Then why do you appropriate them?—I claim to debit the abnormal expenditure against the reserve fund, not the undivided profits. If I cannot debit it against the reserve fund, then I claim to debit it against the fund created by the allowance of 2½ per cent. for risks, which allowance has been made by the Courts, certainly since the sliding scale came into operation.

In further cross-examination, witness went on to explain how he had arrived at £3085 for wear and tear. Taking an average of five years, £332,031 was deducted under the head of "maintenance, renewals, &c.," while the amount actually expended in the account year was £328,946; and the £3085 was the difference. It would not be right to take the average over ten years, because materials were very much more costly in those days. Explaining his "annual sinking fund, £41,130," witness said he had not put down anything for the renewal of retorts, services, or light plant, because this was covered by the allowance made under the head of "wear and tear." It was true that in the case of the East London Water-Works he had allowed 1 per cent. on the value for the perishable portion of the undertaking; but there was a difference between gas and water undertakings. One per cent. here would be too much, having regard to the large sum included in the annual expenditure for renewals. Judging from Mr. Jones's evidence, a water-pipe had a longer life than a gas-pipe; but the difference was probably very little. He had not taken into account that in this Company there was a considerable amount of capital bearing no interest.

Re-examined: The reserve fund was specified by the Act to remain for the purpose of meeting extraordinary expenses from time to time; and it could not be touched otherwise. Therefore, on a change of tenants, the fund would not go away, but would remain for the incoming tenant.

Mr. *Ryde* was recalled, and added to his evidence-in-chief that he had assumed the productive mains to be 2787 yards of 24-inch, 3080 yards of 30-inch, 16,426 yards of 36-inch, and 51,016 yards of 48-inch.

Cross-examined by Mr. LITTLER, he said he had not allowed anything for coke and products consumed by the Company themselves; but if they, in that manner, saved the expense of coals, they lost the sale of the coke, &c. Asked if he had made any allowance for the stock of coke, &c., on hand, he said he assumed a tenant coming into the concern who had capital enough to pay his expenses for five months; also that in this period, although he was paying his expenses, he sold his residuals to the extent of five-eighths of that five months' residuals. Therefore he had remaining three-eighths of five-twefths which he was allowed in stock in that way. Reminded that in the South Metropolitan case his figures worked out at 12⅝ per cent. on the receipts, while here they worked out at 16½ per cent., witness said that here the Company had raised the price of gas 3d.; in the other case they had not. The tenant with the lower price of gas could not pay so high a rent.

Mr. *W. R. Chester*, Engineer and General Manager of the Gas Department of the Corporation of Nottingham, whose district of supply was stated to be about twice the area served by The Gaslight and Coke Company, said he had been for 21 years engaged in the erection and management of large gas undertakings. His valuation differed from Mr. Jones's, first in the matter of stove fixing and repairs. Witness allowed for this £11,502, instead of £26,006. The £37,000 in the Company's account was an unreasonable expenditure to earn about £8000 rental; therefore he had taken the actual cost of stove fixing, repairs, cleaning, and renewals, according to his Nottingham experience, and adjusted the figures to this case. His next difference was in relation to management. He disallowed from the management charges (£61,093) £5500, which consisted of expenses in regard to the landlord's interest, which the tenant should not be called upon to provide. In the "sundry charges," he put the parliamentary expenses as a landlord's charge. Of the £6997 for depreciation, he disallowed £1500 as relating to depreciation of works on leasehold land. For superannuation he allowed £10,069 as the expenses of the tenant included in salaries and wages; the remainder was due to amalgamation charges, and must be borne by the landlord. The tenant's capital he put as £950,000. On this he allowed, not the 17½ per cent. but merely the 10 and 5 per cent. Taking into consideration the expenditure incurred each year, this was ample interest. For renewals he put £20,000. In ordinary cases it would be unnecessary to provide a renewal fund at all; but as in connection with this undertaking there were a large number of new works, which might be considered to have not yet come into their proper ratio for repairs, he allowed £20,000. Insurance he had taken at 3s. 6d. per cent. on £2,000,000. According to Mr. Valon, the Alliance Company already insured small gas companies at that rate, and presumably they would be even more willing to cover larger ones. The total rateable value of the whole concern he made out to be £723,530; and the indirectly productive portion he valued at £249,221. He had taken all the mains of 14 inches diameter and upwards (mains not directly tapped to supply the consumer) as being unproductive. The directly productive value was £474,309. To this he added £209,812, the estimated receipts arising from an additional 3d. per 1000 cubic feet which would have been made had not the Company had in hand the funds to enable them to pay the maximum dividend. He could not say the exact cost of renewing retorts; but 1d. per 1000 feet on the make was a reasonable figure.

Mr. *R. Wilkin Hedley* said that in his valuation of this undertaking he took the Company's figures as to the receipts, except that he disallowed £410 for transfers. He also added £211,384, which he considered would have resulted from the raising of the price of gas by 3d. per 1000 cubic feet. On the other side of the account, he differed from the Company's figures in the matter of repairs and the fixing of stoves, allowing only £8216 for these. He thought no landlord would let his property be reduced in value by a tenant's undertaking to supply stoves which proved such a loss as they did in this case. For lighting the public lamps he took the Company's figures, except that he disallowed £270 for experimental lighting, which was entirely a landlord's matter. He had omitted the "salaries of Directors" and the "parliamentary charges." As to annuities, he had left out those allowed on the transfer of the undertakings of the old Companies. Coming to the tenant's capital, he took 4½ months' working expenditure, considering that this was a sufficient provision till the receipts came in. To test the accuracy of this, he had prepared a table to show what the bank balances would be throughout the year, on the basis of starting with this figure. It proved that at no time would there be a smaller balance than £271,061, and occasionally it would be as much as £929,000. A similar table, taking the initial payment in of £1,255,082, as suggested by Mr. Jones, showed that the bank balance would then vary from £772,775 up to £1,430,853, which would be an unnecessarily large balance. His second item was £40,000 for three months' rates. On the resulting figure of £761,482, he gave 10 per cent. as tenant's allowance for balance at the bank for a large portion of the year. This was more than adequate, considering that management expenses were separately provided for, and that the money would not be required for the whole year. He did not take the meters at the depreciated value of £243,000, as suggested by the Assessment Committee, but at the full cost of £365,000. Under the Act of Parliament, the Company were entitled to charge 10 per cent. for meter-rent and profit. If the depreciated value were taken, it would come to 15 per cent. Interest on loose plant, implements, and furniture, he took at £94,873, which was 15 per cent. upon 1s. per ton of coal carbonized. Repairs and renewals of plant cost during the account year £328,947, £60,000 of which he treated as the tenant's portion, and allowed the remainder in the "statutables." This Company owning property which was part old and part new, there was no necessity to have a separate allowance for renewals. Under their statutory powers, they could not have any renewal fund beyond what they had in the undivided profit. He adopted Mr. Valon's figure of £18,287 for insurance. On these figures the rateable value worked out at £1,050,632, of which £276,833 represented works and unproductive mains.

Mr. LITTLER intimated that he would not go over the same ground again by cross-examining this witness.

Mr. *W. G. Cooke*, examined by Mr. POLAND, said he had made a valuation on behalf of the parishes of St. John's, Hampstead, and Paddington. His first difference with the Company's figures was that, like the two previous witnesses, he allowed for an increase of 3d. per 1000 cubic feet in the price of gas. He also deducted bad debts, £1160, and £6000 for the replacement of capital on the Curtain Road works. For repairs and renewals of stoves, he adopted Mr. Ryde's figure of £10,845, the proportion which would be attributable to this item, having regard to the South Metropolitan case. As to management, the Directors, Secretary, and Accountant acted in a double capacity; and he therefore took off 10 per cent. Law and parliamentary charges he

put down at £3500. He considered that a solicitor at a salary would transact the whole legal business for the hypothetical tenant for about £3000; and he (witness) added £500 for parliamentary charges. He deducted altogether the £4921 for annuities. This was a capital charge; for if the Company had not agreed to superannuate these officers, they would have had to pay so much more purchase-money. He did not allow anything for increase in wages for purification and carbonizing, as these would be included in the accounts, and dealt with in the previous part of the valuation. The tenant's capital he put at £1,300,000, upon which he allowed 17½ per cent. The landlord's share he made out at £858,223, from which he deducted £10,567 for insurance; leaving £847,656, subject to correction, for rates. He adopted Mr. Jones's valuation of the buildings and land; putting 5 per cent. on the former, and 4 per cent. on the latter. This worked out at £279,444; leaving a net result of £394,190, or equal to 15·48 of £2,545,195 gross receipts.

Mr. *Valon* was recalled, and further cross-examined by Mr. LITTLER. He said that when he was connected with the Commercial Gas Company the charge for maintenance was, he believed, 6d. per 1000 cubic feet. He was aware that the Act of Parliament now compelled The Gaslight and Coke Company to put up their new capital to auction; and therefore they had cheap money in return.

The Court then adjourned till the following day.

Saturday, Nov. 7.

On the resumption of the proceedings to-day, additional evidence was given on behalf of the respondents.

Mr. *W. S. Cross*, F.R.I.B.A., Rating Surveyor to the Strand Union, said the original valuation of the Union was £37,230 gross, and £24,796 rateable; and, on his advice, the figures were reduced to £32,725 gross, and £29,750 rateable. He gave this advice after conferring with Mr. Vigers on behalf of the Company. He produced the original valuation supplied to him by Mr. Vigers.

Mr. LITTLER objected that this document was handed to witness by Mr. Vigers without prejudice, and simply for the purpose of a settlement being arrived at.

Mr. POLAND: This witness had interviews with Mr. Castle and Mr. Vigers, and neither of them is called. The document was in no way submitted as without prejudice. It is a detailed valuation for the information of the Assessment Committee; stating what the advisers of the Company at that time thought was the true rateable value of the whole hereditament.

The CHAIRMAN (to witness): Was the document given to you under reserve, and as not to be used?

Witness: With not the slightest reserve.

Mr. LITTLER: Was it not distinctly done for the express purpose of trying to agree upon a figure?

Witness: Undoubtedly.

And was it not for the year 1889—not for the year now before the Court?—That is so.

The CHAIRMAN: I think I must admit the document, *quantum valeat*.

Mr. LITTLER: It seems to me to be an extremely unusual course to adopt at the end of a case, and with the very last witness. If this had been put to one of my witnesses, I might have acted differently. In my view, the question here was one for engineers rather than for valuers; and therefore, although I had valuers, I did not call them. But now we have tendered in evidence a thing which has not been used before, and which was handed to the witness in July of last year for the express purpose of arriving at a settlement.

The CHAIRMAN: There may be inconvenience resulting from the production of this document; but you know you have, after consideration, decided not to put Mr. Castle or Mr. Vigers into the box. I must admit the document.

The document was then put in. It contained in pencil figures the following items: "Loose plant, £106,393;" "Meters, £243,400."

Witness said the items were the exact figures given by him to Mr. Marshall while they were before the Assessment Committee. Proceeding with evidence as to his present valuation, he said the first item in which he differed from Mr. Jones was the cost of stove fixing and repairs and renewals. Mr. Jones gave £37,508; witness gave £12,500, or one-third of the total expenditure. He took three years as the average life of a stove. For parliamentary and law charges, he allowed £3000. Looking at the different amounts expended in past years, and considering that they should be divided proportionately between the landlord and tenant, he considered £3000 a fair division.

The CHAIRMAN: You have not separated the legal from the parliamentary expenses. Have you allowed anything for the latter?

Witness: I have put down £1000, or something like it. Superannuation I have reduced by the amounts credited for the officers of the old Companies. Depreciation is a landlord's charge, and I disallow that. My next item is: "Add extra receipts for increased price of gas." I have calculated the quantity of gas sold in the account year, and to this I have added 3d. per 1000 cubic feet for the ordinary, and 4d. for the cannel gas. For "wear and tear" I put £4200, instead of Mr. Jones's £47,433. I have taken the average of eleven half years; and the figure I allow represents the excess of that average over the actual sum spent in the account year. I disagree with Mr. Jones when he says there was a large increase in the cost of wages for carbonizing and purification; on the contrary, between 1886 and 1891 there has been a decrease. I differ also as to the cost of coal. In the account year the cost was £1,255,316. I have calculated how much that quantity would come to at 14s. 6d. per ton, the price in the year subsequent to the account year; and the difference I accept as the extra value of coal. From that I deduct the amount equivalent to the increased worth of residuals; and £67,500 represents the improved value in proportion to the extra cost of coal in the year following the account year. I thus arrive at the figure of £1,024,654 as a necessary correction for the coal. The tenant's share I bring out at £226,450; and the tenant's capital, £129,400. I first take 450,000 tons of coal, and then calculate that 542,800 tons will be required and received by the average weekly deliveries extending over 4½ months till the Company earn, by their business, enough money to go on with. Therefore I give them 992,800 tons to commence with. For the tenant's stores I allow three-eighths of that quantity, and the same proportion of the working expenses, and I add the quantity of coke they would require, which gives £12,500 to start with; the value of the tar, liquor, and products, £80,000, as claimed by the Company in their case; sundry stores, £157,439; tools and chattels, £106,393—together £1,293,373. I then deduct one-third for sundry stores as the landlord's, £52,480; also the value of residual products, £1,841,754, less 25 per cent. for trade profit. This brings out £631,316, which leaves £609,583, of which I take three-eighths as the allowance for tenant's capital; and to this I add the stock of gas-meters, £243,334, and gas-stoves, £53,665. I put for cash balance at the bank £20,000, *plus* £28,000 consumers' deposits; bringing the total tenant's capital to £1,294,000. Upon this I allow 17½ per cent. This is the fourth time I have valued a gas company's works, and I have invariably allowed them the 17½ per cent. For the sinking fund for renewals, I have taken the structural value as given by Mr. Jones; but I disagree with him as to the lives—taking a longer life for the buildings, and a shorter one for some of the light plant. Insurance I put at 7s. 6d. per cent. on the value of the buildings and plant. For twenty years and upwards, I have acted for the Sun Fire Office in inspecting premises all over the Metropolis; and I have valued many in the vicinity of gas-works. Every building, taking one with another, may be insured for less than 7s. 6d. per cent. But I have allowed this figure as a maximum; and I know very well that, if all the Metropolitan gas-works were offered to the insurance companies, they would strike a bargain at very much less. As to rates, I have taken the structural value at £5,647,559. Five per cent. on this produces £282,378; and I add 5s. 2d. in the pound for rates, which is £72,947. In fixing the proportion of mains to be treated as indirectly productive, Mr. Vigers and I agreed that the carrying mains should include all of 14 inches diameter and upwards. For the general valuation, I adopt Mr. Jones's figure; but, in the interest of the parishes, I must hold to the 14 inches. In the Strand, where the Company have no works at all, there are thousands of feet of carrying mains which do not exceed 10 inches in diameter; and I think it is a fair middle course to assume that a diameter of more than a foot should be required as carrying mains. Finally, I bring out the total rateable value of the actually productive mains and works at £368,550, which is a net rateable value of 15·2 per cent., excluding rates.

In cross-examination by Mr. LITTLER, witness said that, when a stove was fixed in a domestic establishment of any kind, it was reasonable to expect it to be in use for five or six years. On being informed by the learned Counsel that for the half year ending June, 1891, the Company fixed 5445 stoves, and had 3794 returned, he said they probably came out of places where they were fixed five years previously; and the new stoves would naturally stay. It was pointed out to him that this was a recurring quantity in the Company's expenses. From the changes that took place in a city like London, about 70 per cent. of the stoves were, said Mr. Littler, returned in every half year. Witness replied that the expenditure changed as well. He did not agree that 70 per cent. were returned in every six months; but he thought they might have 10 per cent. back. In allowing £3000 for law and parliamentary expenses, he had not examined the bills of costs; it was a pure guess.

Mr. LITTLER: Why do you put down £4200 for wear and tear, when Mr. Jones allowed £47,000?

Witness: I have taken the eleven half years intervening, and the average comes out in that way.

Is it not the fact that, if any tenement or appliance has a given life, you ought to allow so much for depreciation as will correspond with that life? If the life is 30 years, ought not your depreciation over the 30 years to be sufficient to replace the tenement or appliance at the end of it?—If I were valuing for the landlord, I should say yes; but valuing for the tenant, I should say he has nothing to do with it.

If the thing has depreciated, and has to be repaired, is it not proper to ascertain, not only the amount of repairs in the five leanest years you can make it, but what it will cost, one year with another, to keep it in repair?—I see no reason why I should dispute the Company's experience in this matter. They have proved, by many years' trading, that a certain amount of wear and tear is sufficient to maintain their buildings and apparatus; and I have taken the experience of five years. Bear in mind that year by year all the depreciation is being made good out of the revenue.

If you go back 10 years, it is worse for you; if you go back 15 years, it is worse still. Ought you not to take that which you find one year with another, and spread it over the life of the particular chattel?—Yes; and it is so divided.

Cross-examination continued: He arrived at the fact that there had absolutely been a decrease in wages by the amount of the wages given in the Company's statement of accounts. He was not aware that at the present time the price of residuals had fallen enormously. It might be true that, in consequence of improvements, extensions, &c., gas-works were constantly sacrificed before their normal life had come to an end.

Mr. *W. F. Dewey*, Vestry Clerk and Clerk to the Assessment Committee of St. Mary's, Islington, said he was present on the 12th of September last year when the objection made by the Company to the valuation list was dealt with by the Committee. Mr. Castle and Mr. Vigers appeared for the Company, and gave certain figures to enable the Committee, if they thought fit, to reduce the valuation. Witness produced these figures, as taken down by him at the time.

Mr. *J. Owen Perry*, Clerk to the Hackney Union Assessment Committee, produced similar figures submitted by Messrs. Castle and Vigers to that Committee.

Mr. *Valon* was recalled, and further cross-examined by Mr. LITTLER as to his experience at the works of the Commercial and London Gas Companies.

Mr. *H. E. Jones* was also recalled, and stated, in reply to Mr. LITTLER, that in his account he had estimated wear and tear on the principle that it must extend over the life of the subject-matter. The longest life he had taken was 50 years, and the shortest 20 years, for the different sections of the hereditament; so that the average would be 30 years. This was a full life to allow for gas-works, because they were not worn out, but displaced by becoming obsolete. If the inquiry extended over 20 or 25 years, it would be found that the wear and tear charges went much higher than the 6d. per 1000 cubic feet he had put;

they would reach 11d. or 1s. Some of the works had been cleared away absolutely during his time—for instance, the Blackfriars works of the City of London Gas Company, and the Horseferry Road works of the appellants. Witness also went into an analysis of the tables upon which Mr. Valon had founded his estimate of the coal supply; and he contended that it would be altogether unsafe to rely upon it.

Mr. *J. W. Field*, recalled, stated that in the account year the number of stoves supplied was 16,769. As nearly as could be ascertained, the consumption of gas was 100 cubic feet per day per stove; but this was only an estimate. Taking this calculation over the year, it brought out 612,068,000 feet of gas, which at 2s. 6d. per 1000 cubic feet would bring in £76,508; showing a gross advantage of £47,216 to the parishes. In the year ending June, 1891, the same calculation worked out at 2s. 9d. per 1000 cubic feet showed a gross advantage of £105,748. Instead of decreasing, the expenditure for stove fixing increased. During the current half year, there had been a very considerable fall in the value of residuals, especially coke.

Mr. POLAND: Does not the price of coke follow the price of coal?

Witness: Not immediately. The price of gas coal is not directly regulated by the same market that affects the price of household coal. Gas coke is governed more by the steam coal market than by the gas coal market.

This concluded the evidence, and the Court rose.

On the following Monday, Mr. Poland and Mr. Fullarton addressed the Bench on behalf of the City of London Union and the St. Saviour's Union. The last-named Counsel had not concluded his speech at the close of the sitting; and the further hearing was adjourned till Thursday. After Mr. Fullarton's speech, and one by Mr. Marshall, the Solicitor-General addressed the Court on the general issues involved in the case; and Mr. Littler commenced to sum up the whole on Friday. The learned Counsel had not concluded on Saturday, when the further hearing was adjourned. It is expected that he will finish to-morrow; but the decision of the Court will probably not be given for some weeks.

WESTMINSTER COUNTY COURT.—Wednesday, Nov. 11.

(*Before Mr.* F. BAYLEY, *Judge, and a Jury.*)

Pitcher and Co. v. The Gaslight and Coke Company.—Disputed Gas Consumption and Meter Registration.

This was an action brought by the plaintiffs, a firm of wholesale stationers and printers in Newman Street, Oxford Street, to recover £9 14s. 6d. paid to the defendants, under protest, for gas alleged to have been consumed.

Mr. JAMES appeared for the plaintiffs; Mr. THOMPSON represented the defendants.

Mr. JAMES, in opening the case, said the plaintiffs had been supplied with gas by the defendants since 1884; and no dispute had arisen between them until the one in respect of which this action had been brought. On Dec. 22 last year the index of the meter stood at 77,300 cubic feet. This was duly entered upon the meter card; and the quantity then chargeable was shown to be 28,100 cubic feet. The bill for this was duly paid. On Jan. 16—25 days afterwards—one of the Company's inspectors called at the premises, and the index marked 117,000 cubic feet; showing a consumption of 39,700 cubic feet. Another inspection was made on March 20, when the total consumption recorded was 90,100 cubic feet, and the quantity then chargeable was 12,800 cubic feet. The plaintiffs pointed out that this small consumption must be a mistake, inasmuch as the meter was stated to have registered 39,700 feet in January. The Company's man admitted that there was something wrong. A few days later, the senior inspector (Mr. Ditschen) called, and said there must be something amiss with the registration of the meter; and he immediately took the card, and converted the 90,100 into 190,100, and the 12,800 into 112,800, by prefixing a figure 1 in each case—at the same time adding his initials. The plaintiffs protested against this increase, especially as in no winter quarter had their consumption been more than 45,000 feet; and therefore they declined to pay the account. As, however, the Company threatened to cut off the gas if the plaintiffs persisted, the claim was settled under protest. They were willing to pay for the quantity of gas consumed in the corresponding quarter of last year; but this the defendants declined to accept. Plaintiffs therefore sought to recover the difference between that amount and the sum they were charged.

Evidence having been called in support of the plaintiffs' case,

Mr. THOMPSON said the Company had acted under the provisions of the 90th section of the Act of 1868 (31 and 32 Vict., cap. 125). Owing to the small consumption of gas indicated in December, the Company determined to have the meter inspected; and on Jan. 9, it was found to register 1000 feet less than it did 18 days previously. It was therefore concluded that the mechanism of the index had completed its revolutions; and that consequently 100,000 cubic feet of gas had passed without being indicated by the dials.

Mr. *Ditschen*, the Company's senior inspector, said the meter in question was a 10-light one with three dials, and the utmost quantity which could be registered by it was 99,900 cubic feet, after which it would return to zero. He came to the conclusion that this had occurred, and that 100,000 cubic feet of gas had been used beyond what was registered; and he marked the card accordingly.

In answer to questions by the jury, witness said the consumption in the June quarter, with a four-dial meter, was 65,000 cubic feet. This was 10,000 feet above the average.

Mr. *Pitcher* was called, and stated that in the June quarter two extra machines were fixed, and consequently more gas was used.

His HONOUR having summed up, and called the attention of the jury to the provisions of the Act bearing upon disputes arising in respect to the registration of meters,

A verdict was returned for the plaintiffs for the amount claimed, with costs on the higher scale.

Application was made for leave to appeal; but his Honour refused to grant it.

MISCELLANEOUS NEWS.

GREENOCK COR ATION GAS SUPPLY.

Inauguration of a New Holder.

Last Friday afternoon the ceremony of turning on gas to the town o Greenock from the new holder which has been erected at the Inchgreen Gas-Works was celebrated with much *éclat;* the chief performer being Bailie Erskine, Convener of the Gas Committee of the Police Board. There was a large attendance of Police Commissioners, the Harbour Trust, the contractors, public officials, and other townspeople, who were received at the works by Mr. S. Stewart, the Engineer and Manager, Mr. Mackie, the Assistant Manager, being also present. The new holder has been erected on a site which was long ago selected for it by Mr. Stewart, and for which, indeed, a tank was constructed when the other two holders were put up. Messrs. Hanna, Donald, and Wilson, of Paisley, have erected the new holder, which is of the two-lift type, and 122 feet in diameter by 50 feet deep. It has a capacity of about 600,000 cubic feet, and the cost is £6000. After assembling in Mr. Stewart's offices, the company proceeded to the holder, where Bailie Erskine turned on the gas to the town, and declared the holder to be duly inaugurated. Light refreshments were then served. Bailie Erskine submitted the toast of "Success to the New Gasholder," which was heartily received. In the course of his remarks, he said the first Greenock gasholders, two in number, were 35ft. 6in. in diameter, by 16 feet deep, and their capacity was 30,000 cubic feet each. They were contracted for in June, 1827; and gas was turned on to the town for the first time on Sept. 1, 1828. In tracing the progress of the works, Bailie Erskine showed that the annual make of gas has risen from 3,200,000 cubic feet in 1828-29 to 210,398,800 cubic feet in 1890-91; the price in the former year being 12s. 6d. per 1000 cubic feet, and 3s. 4d. now. He went on to say that it was 20 years since the Greenock Gas-Works were removed from the Glebe (Crawford Street) to Inchgreen, and during this time their progress had been alike steady and decided. The works had just been completed by the addition of the new holder; and he was certain it was the wish of every right-thinking citizen that their future might be crowned with success. Provost Rodger proposed "The Contractors." Mr. J. Donald replied; and concluded by asking Provost Rodger and Bailie Erskine each to accept a little *souvenir* of the event of the day. They were duplicate and elegantly-appointed inkstands in oxidized silver, with candlestick, all enclosed in handsome cases. Among the other toasts were those of "The Gas Committee," "The Engineer" (acknowledged by Mr. Stewart), and "The Officials of the Gas Trust."

WEST BROMWICH CORPORATION GAS SUPPLY.

Annual Report of the Gas Committee.

The annual report of the Gas Committee of the West Bromwich Corporation, dealing with the results of the working of the gas undertaking in the twelve months ending March 31 last, has just been issued. The total receipts for the financial year amounted to £37,071; the trading expenditure, to £27,805—leaving a balance of gross profit of £9266. Out of this the statutory payments were made, amounting to £7440; and there then remained a sum of £1825 as a surplus to be dealt with by the Council. On the recommendation of the Committee, the Council resolved to transfer £1000 to the relief of the general district rates of the borough; and this left a balance of £825 to be added to the surplus profits of previous years—bringing up the total to £9247. This amount remains in the hands of the Committee, to be used as the trading capital of the undertaking. The Committee do not possess any power to raise money for working capital except out of the profits of the concern. This they regard as an advantage in some respects, seeing that they do not require to pay interest upon money which would otherwise have to be obtained for the purposes alluded to. The capital spent during the year in the acquisition of land and in the extension of mains, services, meters, &c., was £838; making a total capital expenditure to March 31, 1891, of £173,365. The loan indebtedness has been further reduced by the repayment of a loan of £2000, out of the sinking fund account, which makes a total of £11,800 so paid off. The quantity of gas sold was 201,319,700 cubic feet—an increase over the previous year of more than 6 per cent. This was partly due to an increased number of consumers, and partly to the excessively cold and dark weather which prevailed in the winter of 1890-91. The continued increase in the consumption of gas during the last few years led the Committee to the consideration of the capacity of the works for dealing with such increased demand in the future; and in the early part of the present year, they instructed the Manager (Mr. W. Littlewood) to report upon the condition and capabilities of the works and manufacturing plant, and also upon the additions and extensions necessary to be made to cope with the demand for gas in the next few years. After a consideration of the report, the Committee instructed Mr. T. Newbigging, C.E., to advise them in regard thereto; and his report approved, in the main, of the recommendations of the Manager. The report recommended the extension of the manufacturing and purifying plant, and increased gasholder accommodation. The Committee thereupon recommended the Council to apply to the Local Government Board for sanction to borrow £33,310 for these purposes. Plans, specifications, and estimates are being prepared to submit to the Board's Inspector at the local inquiry which will be held in respect of the application. Parliamentary power is proposed to be sought in the ensuing session to enable the Committee to carry out requisite extensions on land recently purchased, and on other land to be acquired. It is not proposed to expend the whole of the above-named sum immediately, or at one time, but to make such extensions of the plant as may be found necessary to meet the growing demands for gas. It was considered desirable, however, to enlarge the purifying plant in the past summer; and the Committee accepted the tender of Messrs. Kirkham, Hulett, and Chandler, Limited, for supplying and fixing one of their "Standard" washer-scrubbers, having a daily capacity of a

million cubic feet. Contracts were entered into in June last for the purchase of 19,000 tons of gas coal, and 300 tons of cannel, at prices somewhat lower than those of the previous twelve months. The reduced rates, however, are insufficient to bring the cost of coal for the present financial year below the actual cost for the last—in fact, the actual expenditure this year will be about £500 in excess of the previous twelve months, for the reason that the year ending March 31, 1891, included three months' working, together with a stock of coal which had been purchased at the lower prices prevailing before June, 1890. The Committee regret that the efforts made by representatives of the various gas undertakings in the Midland Counties and elsewhere to obtain a rebate on the carriage of gas coal, as previously allowed, have not been successful. The discontinuance of this allowance has the effect of increasing the Committee's coal account by at least £500 per annum, which, coupled with the present enhanced value of the raw material, has tended to a largely increased expenditure under this head. A portion of this increase (although by no means a corresponding return) will, however, be recouped from the enhanced value of coke. The circumstance of the increased cost of coal, coupled with the large advances in wages recently made, has necessitated an advance in the price of gas in a number of towns in the United Kingdom. At West Bromwich the price has not been increased, but the amount of profit has been reduced; and, speaking of the country generally, it may be said that there has been a strong disinclination to raise the price of gas. The manufacturing plant received special attention during the year; several renewals of retort-benches having been carried out on the recommendation of the Manager. In the out-door department, the mains and services were renewed and repaired where necessary; those portions of the borough which are affected by mining operations receiving particular attention by the Superintendent (Mr. W. H. Wayte), in order to discover and repair any pipes fractured through subsidence of the ground. The annual returns of the quantity of gas lost by leakage consequently bear favourable comparison with those of other towns. Extensions of mains were made into parts of the borough previously unprovided therewith.

THE ELECTRIC LIGHT IN A GAS-WORKS.

The Engineer and Manager of the Dewsbury Corporation Gas-Works (Mr. Charles A. Craven) occupies now a rather unique position in the gas industry, inasmuch as he has adopted the electric light in a portion of his works. It appears that for some time considerable difficulty was experienced in carrying on operations in the purifying-house, especially when extra work had to be done in the winter season, owing to the inadequate light furnished by the safety gaslights placed in the walls. Considering how he could safely obtain more light for his men, Mr. Craven decided that it could best be done by adopting electricity; and accordingly he recommended the Corporation to try incandescent electric lamps. To this they agreed, and the use of the light in the purifier and engine houses commenced on the 22nd ult.; and, so far, this novel application of electric lighting has been satisfactory. As the plan may commend itself to the notice of some of our readers, we give a few particulars of the installation, which Mr. Craven has recently forwarded to us. The lighting is at present done by four 16-candle power incandescent lamps for the engine-house, and ten similar lamps for the purifier-house; but it is in contemplation to replace two of the lamps in each house by others of higher power. The dynamo was specially made by Messrs. Austin and Myers, of Armley, Leeds; and up to now it has run well. It is located in the engine-house, and is driven direct from the fly-wheel of the stationary engine. To the foregoing details, Mr. Craven adds the following general remarks: "Some of my brethren in the gas profession seem much struck with the novelty of the idea. I am told that it is 'a funny thing to bring the electric light into gas manufacturing operations.' Well, I reply that our gas is frequently used in providing motive power to produce the electric light; and, that being so, why should not we utilize the light for any purpose where it can advantageously be used? If I dare put gas-lights where I have placed incandescent lamps, I could get as much light as I want, and at a cheaper rate than by using the electric light. Our surplus power, however, enables us to produce the light without much extra cost. We are intending to make some few additions to the fittings of the lamps, which will add somewhat to the cost, but which will at the same time be an additional safeguard."

The Threatened Strike of Gas Stokers at Bradford.—A deputation of the gas stokers in the employ of the Bradford Corporation, who have been threatening to strike because of an alleged reduction of 6d. per shift in their wages in consequence of the introduction of stoking machinery, have waited upon the Gas and Electricity Supply Committee to ventilate their grievance. Upon the suggestion of the Chairman of the Committee (Alderman Priestman), it was determined to submit the dispute to the arbitrament of the Bradford Board of Conciliation.

Extensions at the Wolverhampton Water-Works.—Last Wednesday week, two new engines were started at the Cosford pumping-station of the Wolverhampton Corporation. One of the engines will be used for pumping water from the well; and it is capable of raising 4 million gallons in twenty-four hours. The other will be employed in forcing the water through the mains to the Tettenhall reservoir, from which the town is supplied. The engines were started, in the presence of a numerous gathering, by the Chairman of the Water Committee (Mr. Alderman J. G. Wright). At a subsequent luncheon, the Mayor, on behalf of the Water Committee, officials, and members of the Corporation, presented Alderman Wright with a magnificent silver bowl as a token of their admiration of his valuable services during the twelve years he has held office. It may be added that, in the past few years, about £23,000 has been spent in connection with the Cosford pumping-station; and the whole of the engineering work has been carried out under the supervision of the Water Engineer (Mr. Lyons Wright).

EXPLOSION AT AN OIL-GAS WORKS.

On the night of Saturday, the 7th inst., a young man lost his life, and damage to the extent of £2500 was caused, by a fire and an explosion at the Caledonian Railway Company's Gas-Works, Perth. Several years ago the Company erected works at Perth for making Pintsch's gas for their through carriages. The buildings form part of a block in which are situated the engine-house, gas-house, and smithy. They are of one storey, about 250 feet long by 40 feet wide, and are built of stone with a wooden roof. After being manufactured, the gas is carried to a gasholder outside, and is then pumped by direct-acting engines into four large steel reservoirs, which hold 10,000 cubic feet of gas, before they are pressed up to 150 lbs. per square inch. Just before leaving off work, about half-past eight o'clock on the night in question, John Wilkinson, the man in charge of the works, went outside with some refuse tar. When he returned, he observed that the house containing the reservoirs was on fire. He and the night watchman endeavoured to put out the flames; but in this they were unsuccessful. The alarm was given, and the Company's fire-engine was quickly turned out, and did splendid service. The City Fire Brigade reached the works before nine o'clock, but the fire spread with great rapidity, and by the time the water was turned on, it had got a good hold. Assistance was also sent from Her Majesty's General Prison adjoining the works. Fears were entertained of an explosion; but, notwithstanding, the firemen and others worked bravely to get the fire under. The roof of the portion of the building above the gas-house fell in shortly after nine o'clock; and about a quarter-of-an-hour later, two of the reservoirs burst with a terrific noise. Huge sheets of flame rose high in the air. One of the reservoirs was thrown through the front wall of the gas-house against the wall of the engine-fitting shed, a distance of nearly 40 feet, shattering the whole of the glass in four large windows. A young man named James Barlas, aged 20, who was assisting the firemen, was struck by the reservoir and was terribly injured; and he was conveyed to the Infirmary, where he died the following morning. Wilkinson, the gas-man, was in the building at the time of the explosion, and had a marvellous escape. He fell down stupified, but was uninjured, and soon came round. The second reservoir was hurled through the north wall of the gas-house. The others remained intact; but one of them was shifted out of its bed. Many buildings in different quarters of the city were shaken by the violence of the explosion. Anxiety was felt in case the fire should spread to the gasholder and oil-tank; but fortunately this did not occur, although the former was blistered with the heat. Two pumping-engines and two large reservoirs were very much damaged; the sides of one of the latter being torn from end to end. The roof of the gas-house and a large portion of that of the smithy, with a considerable quantity of workmen's tools, were totally destroyed. No clue as to the origin of the fire has as yet been obtained.

GAS v. ELECTRIC LIGHTING AT HASTINGS.

The question of continuing the electric lighting of the sea-front at Hastings occupied the attention of the Town Council at their meeting on the 6th inst.; the subject coming before them on a recommendation, submitted by the Public Lighting Committee, that the existing contract (which will expire on the 26th inst.) for the 15 arc lamps which the Electric Light Company have erected between the Queen's Hotel and Warrior Square, should be renewed for another year. Considering how frequently the example of the Hastings Corporation, in adopting the electric light for the illumination of their grand marine promenade, has been held up in other places to diffident councillors who have been "halting between two opinions" as to discarding or retaining gas in the public thoroughfares, it would have been supposed that the system was absolutely irreproachable. Paragraphs which have lately appeared in the JOURNAL, however, have shown that the light is still far from reliable; and now complaints are heard as to its cost. Therefore the Committee's recommendation was not at once agreed to with a unanimity which would have indicated general satisfaction. In fact, one councillor (Mr. Hutchings) ventured to propose, as an amendment to the motion to adopt the Committee's report, that gas-lamps, of exactly similar power to those now in use on one portion of the sea-front (West Marina), should be substituted for the present dual system. It should be explained that the Marine Parade at Hastings is altogether about 2¾ miles long, and 2 miles of it is lighted with "Whitehall" lamps, each consuming 30 cubic feet of gas per hour, and giving an effective light of upwards of 100 candles. On the remaining portion stand the old 5-feet per hour lamps as originally fixed. But, without in any way interfering with them, the electric lights have been put up, and have been in use for about seven years. They burn from sunset until eleven o'clock every night. These particulars will enable our readers to better understand the remarks made in support of the amendment.

Mr. Hutchings assured the Council that he should be very sorry to do anything to injure the Electric Light Company, the Directors of which had, he said, struggled most manfully, against adverse circumstances, to carry out public improvements. But it was no part of the business of the Corporation to look after the interests of public companies; and if he could show them that they could obtain a much better and steadier light at reduced cost, it would be their duty to adopt his amendment. Three years ago, when he first entered the Council, he objected to the renewal of the contract with the Electric Light Company; and he was then assured that there were bound to be considerable improvements in their system of lighting. He failed to discover these improvements as carried out along the sea-front. The vagaries of the lamps were most painful and confusing. First they shed a brilliant light; and then it was almost dark. Beyond this, the dual system of lighting was most ridiculous. The gas-lamps looked, in comparison with the electric lights, more like "penny dips" or rush-lights than anything else. He had obtained from the Engineer of the Gas Company (Mr. C. E. Botley, Assoc. M. Inst. C. E.) some particulars of

the cost of the lighting he proposed, and for which the Company would be prepared to carry it out. At present there were 15 electric lamps, about 100 yards apart, together with 30 gas-lamps. The electric light lamps cost £30 each per annum, making £450; and the gas-lamps £4 4s. 2d. each, making £126 5s. per annum. The total cost, therefore, was £576 5s. To do the whole of the lighting with gas with equal illuminating power to the electric light, but with far better distribution of illumination, the cost would be, for 40 "Whitehall" lamps, 30 yards apart, burning full power up till eleven o'clock, and one burner after that hour, of a similar pattern to those already in use, at £10 13s. 8d. per lamp, £427 6s. 8d. for the year. There would thus be an annual saving of £148 18s. 4d. by the use of gas. Or if the lighting were exactly similar to the Marina lamps, each being 40 yards apart, the annual saving would be £202 6s. 8d. The speaker went on to say that the "Whitehall" lamps were much appreciated by the residents and visitors, and gave a splendid and steady light. Compared with the electric light, they were a distinct advantage.

Mr. Hutchings was supported by Mr. Eaton, who seconded the amendment. He said it would be in the recollection of many members of the Council that he protested a year ago against the system of lighting the sea-front by electricity. They were given to understand most distinctly, when they adopted it, that they were to pay £30 per light, and with the idea that later on there should be some reduction made. The question was fought out from year to year; but of late it seemed to be taken for granted that the same amount should be charged. He thought a steady light, such as they had in the gas-lamps, was preferable to one which kept "bobbing up and down," and which, to his mind, was an "unnatural" light. After some remarks from other councillors, who all expressed the opinion that the question was too serious to be settled off-hand, the matter was referred back to the Committee.

The foregoing proceedings do not call for comment; they speak for themselves. Attention may, however, be directed to one concluding remark of Mr. Hutchings. He called the attention of the Council to the fact that they had had a "striking mandate" from their constituents to "work on thoroughly economical principles." The speaker availed himself of this action by the ratepayers to clinch his argument in favour of gas. For it is an instructive thing that, even in Hastings—a fashionable pleasure and health resort—people are beginning to find out that they can pay too much for the so-called "attraction" of electric lighting; and the amendment which caused the reference of the lighting question back to the Committee only gives expression to a feeling which has lately been manifesting itself against a continuance of what is regarded as extravagance. This is simply what was anticipated long ago by those whose mental vision was not so dazzled by the new illuminant as to prevent them from seeing things clearly; and whatever may be the outcome of the Council's action, the comparative figures laid before them by Mr. Hutchings will cause both members and constituents to rub their eyes.

THE STANDARD OF LIGHT.

The following remarks on the above subject, which appeared in a recent number of *Industries*, will doubtless be read with interest in the present phase of the question with which they deal:—

We have on several occasions during the last year or two referred to the importance of altering the present standard of light, and have urged the Board of Trade and the London County Council to take immediate steps towards such a desirable object. It would appear from a recent report of the Sanitary and Special Purposes Committee of the latter body that it is again complaining of its inability to do anything in this matter. It has, however, at last been admitted that the present "parliamentary candle" is a most unsatisfactory standard of light; but although the Board of Trade, in a recent communication to the Council, assent to the appointment of a Scientific Committee to consider what the standard of light should be, neither the Committee nor the Board of Trade are able to find the necessary funds for such an inquiry. It is curious, however, to note that both these bodies complain of want of funds at the same time, especially as ten years ago the Board of Trade appointed a Committee for this purpose. Even if this Committee was unremunerated—which seems improbable—it issued a very valuable report on this subject. We have already been compelled to find fault with the ponderous nature of the machinery of the County Council; and we are now beginning to doubt whether—even if it could be induced to overcome the inertia which exists—any work produced by it would be of a satisfactory character.

We should like to ask, in all seriousness, why the Board of Trade think it necessary to have a new Scientific Committee to report on this question, when the last report still remains available as a basis for new legislation. Is the County Council—which has decided to introduce a Bill next session—forbidden to utilize the former report, or is it intentionally putting difficulties in the way by a long and useless correspondence with the Board of Trade? Surely a solution of the difficulty would be found in the Sanitary Committee of the County Council and the Board of Trade constituting themselves into the Committee required, if a Committee be absolutely necessary, to discuss the report of the last Scientific Committee. We are confident that the Metropolitan Gas Referees would volunteer to assist such a Joint Committee in deciding the question at issue. The County Council have already in their employ not only Mr. Dibdin, but twenty or more Gas Examiners, who could easily be invited to assist the Committee in their undertaking. From what we know of the existing staff of the London County Council, we feel sure that its members are all desirous that the present sperm candles should be relegated to the past, and would be only too glad to help a Joint Committee to speedily settle this question. The County Council, however, seems inclined to ignore what has been done in the past, for there is not only existing the report of the Committee of the Board of Trade of 1881, already alluded to, in which the adoption of the pentane air-gas standard is recommended, but also resolutions passed by the Metropolitan Board of Works in 1887 and the Standards of Light Committee of the British Association in 1888 in favour of the same standard. Is it possible that the tardiness shown in this matter is in part due to the modesty of the acting Metropolitan Gas Referees?

We have shown how a representative Committee might be formed, and that there seems sufficient scientific information available to be embodied in a new Bill. As to the success of such a Bill, it is natural to suppose that opposition will come from the Gas Companies, who believe that a more rigid standard would be contrary to their interests; but, on more than one occasion, the leading Gas Companies have asserted before Dr. Williamson's court that it is necessary for them to supply the public with gas of a much higher illuminating power than they are legally required to send out, in order that their gas may not be condemned by an erratic candle standard.

Although it is, perhaps, bold for us to criticize the action of the Board of Trade in this matter, we should like to protest against its recent decision to standardize the Evans and Letheby photometers. These photometers were devised for the parliamentary candle; and if, as the Board of Trade indicate in their letters to the County Council, it is anxious to banish the candle from the photometer, the Board can scarcely be in earnest in insisting that all the gas companies now working under the Gas-Works Clauses Act should go to the trouble—which Brentford, Leighton Buzzard, and Godalming have already done—of having their instruments verified by the Standards Department, while hoping that the County Council, before the close of the coming session, will have obtained an Act making the candle illegal, and consequently making the photometers, specially devised for such a standard, obsolete. We hope that the new Bill will decide (1) the new standard, and (2) the photometer to be used therewith, not only in the testing-stations controlled by the London County Council, but throughout the provinces.

The Water-Works Purchase Question at North Shields.—A vote of the ratepayers has been taken at North Shields on the question of whether or not the Corporation should take the water supply into their own hands, with the result that 2117 voted for the proposal, and 2206 against it; being a majority of 89 in favour of the opponents.

Oriental Gas Company, Limited.—The accounts of this Company for the year ending June 30 last show that the position of the concern has been well maintained. There has been a substantial increase in the revenue, the total amount of which was £87,550. The expenses of manufacture and distribution came to £49,804; so that a balance remains of £37,746. In their report the Directors refer, with regret, to the death of Mr. Alfred Hersee, who for thirty years so ably and devotedly watched over the interests of the Company as its Secretary, and of Mr. Henry Solomon, who for six years was an esteemed member of the Board. Mr. J. Blacket Gill has been appointed provisionally to fill the vacancy on the Board; and the consequent vacancy in the auditorship has been filled by the appointment of Mr. A. T. Eastman. In view of the long and excellent services of the late Mr. Hersee, and confident of the support of the shareholders, the Directors felt that it was but fitting, as a mark of the appreciation in which they held him, to make some allowance to his widow; and they have decided that £100 per annum be paid to Mrs. Hersee during her widowhood. During the year there has been the satisfactory addition to the total of public lamps of 294; and a further order has been received. The number of private consumers has been increased by 220, adding 974 burners. In the course of the twelve months, 7 miles of pipes were laid for the supply of new public lamps. Coke has been sold more readily this year; but the stock on hand is still large, owing to the competition of "Up Country coke." The shops opened by the Company in Calcutta to facilitate the sale of coke have proved successful. The railway siding, mentioned in the last report, for carrying coal direct into the works, is nearly completed; and a great saving in the cost of carriage is expected. The balance of general revenue account (after carrying £2000 to reserve) is £31,954, out of which the Directors recommend a dividend of 6 per cent., free of income-tax; making, with the interim dividend of 4 per cent., a total of 10 per cent. for the year.

The Promotion of the Tarapaca Water-Works Company.—In the Queen's Bench Division of the High Court of Justice on the 9th inst., the case of *M'Grigor v. Hart* came before Baron Pollock and a special jury. It was an action to recover £3000 upon an agreement; the plaintiffs being Dr. A. M'Grigor, of Glasgow, and other Glasgow gentlemen forming a Syndicate to float the Tarapaca Water Company, with the object of supplying water to the town of Iquique, in the Republic of Chili. The defendants were Elizabeth Hart, executrix of Thomas Hart, deceased, and Alexander Cochrane. According to the statement of Mr. Lawson Walton, Q.C. (with him Mr. Dyke Ackland), the late Thomas Hart obtained a concession from the Government of Chili to provide a supply of water for Iquique, which was at the time dependent for water upon the Corporation. Having obtained the concession, Hart came over to Glasgow, where he saw Dr. M'Grigor and other gentlemen, who formed a high opinion of the concession, and agreed to form a Syndicate with the object of floating a Company. To obtain the necessary information to lay before the public, an Engineer had to be sent out to Iquique. Plans were prepared, and analyses of water, &c., were made; the preliminary expenses altogether amounting to £3000. Owing, however, to adverse influences in Glasgow, the Syndicate failed to float a Company; whereupon Hart went to London, and entered into an agreement with the Syndicate to send the documents in their possession for inspection in London—he and his partner Cochrane agreeing, in case of the floating of a Company in London, to pay the £3000. The Company was floated, and became a great success. Hart died; but Cochrane, who was said to have received the whole amount of £10,000 in cash and £15,000 in shares (which were at a premium), left England and went to Chili without paying the Syndicate. The defence set up was (1) that the Company had not been floated; (2) that the documents had not been produced before the floating of the Company; and (3) that Dr. M'Grigor had no interest in the Syndicate. These defences the learned Counsel denounced as mere pretences, and said the action was really undefended. Mr. Bingham, Q.C., and Mr. Isaacs appeared for the defendants. The jury after a brief consultation, found for the plaintiffs for the full amount claimed, and 4 per cent. interest—in all, £3420. Judgment was given accordingly.

THE LONDON COUNTY COUNCIL AND THE WATER QUESTION.

Among the reports presented at the usual weekly meeting of the London County Council last Tuesday, was one by the Special Committee on Water Supply and Markets. It opened with the statement that a reply had been received from Lord Salisbury to the letter addressed to him by the Chairman of the Council (Sir J. Lubbock, Bart., M.P.) in December last, as to a suggested inquiry, at the instance of the Government, on the Metropolitan Water Question; and that it was to the effect that the matter was having careful attention. Passing on to deal with the joint action of the Council and the Corporation on the water question, satisfaction was expressed by the Committee that the two bodies are now entirely at one on this matter; and, in order to give effect to the understanding lately arrived at, they submitted a recommendation that the Council should promote, in conjunction with the Corporation, a Bill dealing with the water supply of London and the adjacent districts, based upon the agreement of the 13th of May last; and that the Parliamentary Committee should join them in taking the necessary steps to carry this out. Reference was next made to the inquiry instituted by the Council into the water question, on which, it will be remembered, they have power to expend a sum not exceeding £5000. The Committee reported that they had already obtained a large amount of information; but that it required much skill and labour before any complete plan or proposal for the settlement of the question could be presented to the Council. They had been considering what was necessary for completing the inquiry; and they submitted a report prepared, under their direction, by the Chief Engineer (Mr. A. R. Binnie, M. Inst. C. E.), indicating the steps which he considers necessary for the purpose. They approved of the report, and had given instructions for carrying on the inquiry on the lines indicated in it. The Committee went on to point out that the amount which Parliament authorized the Council to expend will only be sufficient to carry on the inquiry up to about March next; and they thought it essential that the Council should obtain enlarged powers, as, from the Engineer's report, the inquiry he recommends will probably enable the Council to come to a decision upon the whole question. They therefore submitted the following recommendation: "That it be referred to the Parliamentary Committee to take, in conjunction with the Special Water Committee, the necessary steps in the ensuing session of Parliament for (1) enlarging the powers of the Council to expend money in making the inquiry already authorized, and (2) enabling them to pay the expenses attendant on the introduction and promotion of Bills on the water question." These recommendations have since been agreed to.

On the same occasion, a "Memorandum" prepared by the Deputy-Chairman (Mr. A. H. Haggis) on the subject of the water supply, "in reference to the future needs of London and the surrounding districts, and the obligations of the Companies in relation thereto," was ordered to be printed and circulated. Mr. Haggis begins by asking: "Are the Companies provided with an unimpeachable supply, sufficient not for the present time merely, but for such a lengthened period that the consideration of the new sources need not be undertaken for years to come?" Upon the answer to this question will, he says, largely depend the value of their undertakings to the Council, if it should become the Water Authority. He then proceeds to deal with the Company's legal obligations to provide, subject to certain conditions as to payment, a sufficiency of pure and wholesome water throughout the districts comprised within their respective areas. Discussing next how far the present supplies are adequate for the future, he points out that if London had to obtain a fresh supply from Wales or any other distant ground, two or three years would probably be required to prepare the plans and to obtain parliamentary powers, and at least 10 or 12 years more to execute the legal preliminaries and carry out the necessary works; so that at the most moderate computation, without allowance for delays or mishaps, 15 years would elapse before the wants of consumers could be met. If the present supply, therefore, were sufficient to provide for the increase of population during the next 15 to 20 years only, it would be imperative that the consideration as to a new supply should be undertaken at once; and the requisite capital outlay would be imminent, seeing that the expenditure would commence at the initial stage of the enterprise, and not at the period when the supply became insufficient. It will accordingly, he thinks, be necessary for the Companies to show that they have adequate supplies to meet the wants of the growing populations of their districts for a much longer period than 20 years, in order to avoid the depreciation in the value of their undertakings, which must necessarily be occasioned by early expenditure for the provision of a new source. After quoting a number of figures to indicate the rate of growth of the populations served by the Companies, Mr. Haggis says that, in looking to the future wants of London and the surrounding districts, we may fairly anticipate that the increase in the demand for water during the next two decades will be at least in equal ratio to the growth of the past 20 years; the probability being that it will be in larger ratio, considering that the sanitary requirements will be more stringent, and will necessitate a much freer use of water, and that baths are now being much more generally provided in houses than they were in the past. "But," he continues, "I will suppose that the consumption between 1890 and 1910 will increase in the same ratio as from 1870 to 1890, which was nearly 70 per cent. In that case, the daily average quantity of water required in 1910 would be 295 million gallons, being an advance of 120 million gallons per day over 1890. Even if the same quantity only were added in the 20 years as in the previous period, it would amount to 71 million gallons, or a total of 246 million gallons on an average, per day, to which must be added 10 per cent. for the maximum months." How, Mr. Haggis asks, is this vast quantity to be obtained from the present sources? The Thames supply has, he says, already nearly reached its limit; the maximum quantity allowed to be taken being fixed at 130 million gallons. At the present rate of progress, this limit will be reached in less than five years; yet five out of the eight Companies are practically dependent upon this river for their supplies. The Lea is already taxed to its full capacity; so that no appreciable assistance can be obtained from that river. During the last three or four years the supply taken from the springs and wells in the Lea Valley has been augmented 50 per cent.; and the increase continues. How prejudicial the effect of this enormous abstraction of underground water is upon the surrounding districts has been made abundantly clear; and it is obvious, Mr. Haggis says, that the most strenuous endeavours will be made by the local authorities to prevent, as far as possible, the risk of further depletion of their wells and streams. Mr. Haggis sums up the case as follows: "From the Thames there is a margin of 25 million gallons between 105 millions, the maximum already abstracted, and the authorized maximum of 130 millions; while from the Lea no additional supply can be obtained. So that the underground water is the only present source available for procuring the remainder of the large quantity estimated to be required by or before the year 1910. It is improbable that the intake from the Thames will be allowed to be enlarged, as the resources of the river will be strained to the utmost to provide the 130 million gallons; and even if there should be sufficient supplies of underground water to make up the deficiency (which is very doubtful), the prejudicial effect of such an enormous abstraction upon the wells and streams of the districts would be so serious, that public opinion would probably prevent its being taken. The necessity, therefore, for the provision of a new or supplemental supply, on the ground of insufficiency alone, altogether irrespective of the question of purity, would appear to be paramount and urgent. From the statistics I have given, it is evident we shall within a few years arrive at a crisis in connection with the water supply of London. Already there is a barely sufficient reserve for the interval that is required for the preparation and carrying out of a scheme for a new supply. I offer no opinion here as to whether it is possible for the supply to be obtained by the construction of storeage reservoirs in the watersheds of the present rivers, or whether it will be necessary to secure it from an altogether new source, although all the evidence laid before the Council points to the impracticability of the former course. But, in any case, a large outlay of capital will be at once required; and this impending and onerous liability must, in the event of purchase by the Council, be taken into account in estimating the value of the Companies' undertakings.

STOCKTON AND MIDDLESBROUGH WATER BOARD.

The Half-Yearly Report.

The accounts of the Stockton and Middlesbrough Water Board for the half year ending Aug. 13 last shows that the capital expenditure for the six months has been £46,515; bringing up the total cost of the undertaking to £1,462,588. Of the capital expenditure during the half year, the principal items are as follows: On account of Hury reservoir, £8730; Blackton reservoir, £4670; flood water channel, £10,769; conduit No. 5, Sadberge to Eston, £1976; conduit No. 4, gravitation main, £10,791; conduit No. 2 (1884), Broken Scar to High Coniscliffe, £5660; and extension of supply mains, £684. The sums received on capital account in the course of the six months amount to £45,000; bringing the total up to £1,477,900—being £15,312 more than the amount expended. The revenue account shows the income to have been £31,882; being a decrease of £1101, as compared with the preceding half year—the decrease being accounted for by a diminution in the demand for water for manufacturing purposes. The expenditure on revenue account amounts to £7828; being a decrease of £126, compared with the preceding half year. The balance carried to net revenue account is £24,054, as against £25,038 in the previous half year, and £24,144 in the six months ending Aug. 13, 1890. The net revenue account is debited with several payments on account of alteration of the engines at Broken Scar and other matters, and is credited with the interest allowed by the bank. After being dealt with in this manner, there remains a balance of £36,889, including the sum of £13,245 brought forward. A sum of £30,000 has been paid to the Corporations and Local Board; leaving £6889 to be carried forward. In the half year the supply of water for trade and manufacturing purposes, which up to the date of the last report had continued steadily to increase, has begun to contract in consequence of the slackness of the trade of the district; and, as stated above, the revenue account has felt the effect of this diminished demand. The Local Government Board have granted the requisite permission for the Kirkleatham Local Board to borrow the sum of £4000 for the purpose of purchasing the Water Board's interests in the Local Board's district, and notice has been served on the Water Board of the Local Board's intention to apply to the Local Government Board for the appointment of an arbitrator to fix the price which the Water Board has to receive for such interests. The Local Board offered the sum of £2669 as the purchase-money, which the Water Board refused; and then, on a request that they would name a price, the Water Board, acting on the advice of Counsel, declined to do so. This report was approved at the annual meeting of the Water Board last Wednesday.

Sutton-in-Ashfield Gas-Works.—The gas undertaking at Sutton-in-Ashfield, which was purchased of the old Company some years ago by the Local Board, £26 being given for £10 shares, is (says the *Sheffield Independent*) at present in a critical condition. For some few years there has been a deficit, amounting this time to £403, which will increase the district rate by about 5d. in the pound; and experts have advised improvements in the plant at an estimated cost of £4000, by which means there would be a saving of £400 a year in coal and other directions. Plans presented for the new holder, however, alone require an expenditure of £3200, bringing the total up to about £5000; and fuller inquiries convince the management that the savings would be nearer £275, still causing a deficit when the new capital is obtained. At present the price of gas is only 3s. per 1000 cubic feet, with a lower scale for large consumers; and the feeling is that, if the ratepayers will not assist by more generally burning gas under such favourable conditions, any deficit must be thrown on the rates. The capital charges now amount to 1s. 6½d. on every 3s. received for gas; and a deputation has been appointed to inspect other works, and report to a meeting at which the question will be fully discussed.

THE VOLATILE ORGANIC MATTER IN POTABLE WATER AND ITS ESTIMATION.

At the Meeting of the London Section of the Society of Chemical Industry on the 2nd inst., at Burlington House, Piccadilly, two papers were read: (1) On the "Volatile Organic Matter in Potable Water, and a Simple Method of Estimating Dissolved, Fixed, and Volatile Organic Matter in Water," by Mr. W. C. Young, F.I.C., F.C.S., Consulting Chemist to the Lea Conservancy Board; and (2) on "Some Experiments on Petroleum Solidification," by Dr. Samuel Rideal, Lecturer on Chemistry at St. George's Hospital. An early opportunity will be taken of giving an indication of the contents of the latter paper. Meanwhile, we to-day devote attention specially to that by Mr. Young.

Mr. YOUNG commenced his paper by briefly alluding to the experiments made by Tiemann and Preusse to prove the existence of volatile organic matter in potable water; to the directions given by Frankland for the preparation of distilled water free from organic matter; and to the views of Berthelot and André that the peculiar odour emitted by garden soil after a summer shower was due to volatile organic matter. Phipson, he said, confirmed this, and stated further that chalk and other porous rocks gave a similar odour when moistened, which was due to the same cause. This being so, the presence of volatile organic matter in natural waters might, the author remarked, reasonably be expected; and further, the products of fermentation being largely volatile and soluble compounds, it would seem that all waters polluted by decomposing organic matter must contain volatile organic matter.

Some observations which the author had made indicated, beyond a doubt, the presence of appreciable quantities of volatile organic matter; and, as a result of his experiments, he was able to submit a process by which the actual amount of fixed and volatile organic matter might be estimated, together or separately, in a water. As it seemed to him hopeless to attempt to separate the organic matter directly from a water residue, he directed his attention to separating as much as possible the other constituents, and determining the organic matter in the remainder by loss on ignition. The following is the description, in the author's own words, of the process which he ultimately adopted to determine the total organic matter: 1 litre of water, to which 0·5 gramme of dried and ignited sodium carbonate is added, is distilled in a conical iron still of about 2 litres capacity, attached to a tin worm condenser. The distillate is received in a graduated measure; and when 970 c.c. has been collected, the heat is removed, the still disconnected, the contents and washings placed in a platinum basin, and evaporated to dryness on a water-bath. A little pure distilled water is then added, filtered through an asbestos plug into a platinum basin, dried on a water-bath, and subsequently heated for an hour in an air-bath at 150° C. After cooling thoroughly in a good desiccator, the basin and contents are weighed in a quick balance. The residue is then ignited at a low temperature, cooled and weighed, and the loss noted. The ignited residue is then dissolved in water, excess of sulphuric acid added, and standard solution of potassium permanganate (1 c.c. = 0·0001 gramme of oxygen) added until the colour remains permanent after five minutes. The weight of oxygen lost, thus ascertained, is deducted from the loss on ignition, and the difference is the organic matter. To determine the fixed organic matter, the same course is followed, except that the sodium carbonate is not added until the concentrated water is transferred from the iron still to a platinum basin. To determine the volatile organic matter, the distillate from the last-mentioned process is placed in the still, together with 0·5 gramme of sodium carbonate, and distilled until about 25 c.c. remains in the still; afterwards proceeding as before, except that it is unnecessary to ascertain the oxygen lost by ignition. The result represents about two-thirds of the total volatile organic matter present; and further small quantities can be recovered from the distillate by repeating the process. The asbestos used for filtering is prepared in the form of pulp. It should be white and free from hard pieces, ignited, boiled with dilute hydrochloric acid, thrown on to a funnel and washed free from acid, then boiled with strong solution of sodium carbonate, thrown on to a funnel and thoroughly washed. The filter is made by placing a small perforated platinum cone in a sheet-iron funnel, and covering it with the asbestos pulp. The asbestos is then washed down, and pure distilled water passed through, until the droppings are clear, when the filter is ready for use. The process is extremely simple, requires little personal attention, and can be completed within four hours.

Having described what he called the "chemical aspects" of the process, the author referred to some experiments he had made with known weights of various soluble organic compounds, to show the accuracy of the process. He then gave, in tabular form, the results of a number of experiments with various waters. The first table embodied the results obtained by the author's process with the East London Water Company's water, drawn from the main at his laboratory in the offices of the Board of Works for the Poplar District. The first column of figures gave the non-volatile organic matter; the second, the volatile; the third, the sum of the two preceding; and the fourth, the total organic matter obtained in one operation. The figures showed that volatile organic matter was present in considerable quantity in the East London water, exceeding that of the fixed organic matter in every case, as the figures represented not more than two-thirds of the total present. A comparison of the figures in the third and fourth columns afforded a fair test of the accuracy of the process; and, with two exceptions, they agreed fairly well with each other.

In the next table Mr. Young gave the total organic matter, together with the free and albuminoid ammonia and oxygen required (Tidy's method), in a variety of waters of different degrees of purity. The two first samples were exceptionally pure (Hoddesdon water from chalk wells, and water from the River Beane, a tributary of the Lea); the next two were natural spring water; the two following, river water as taken by the New River and East London Companies for public supply; the next three, well waters undoubtedly polluted; and the others, clarified sewage waters. From the figures, it appeared that there was no definite relation between the oxygen required or the albuminoid ammonia and the total organic matter in solution. Samples from the source of the Lea and of the New River were taken on April 14 and 15 last, and from the intakes of the New River Water Company and the East London Water Company on April 21. The weather for some time previous had been fine and dry; and therefore they were fairly comparable. The results obtained by this process on these samples established the interesting fact that the water rising in the springs in Leegrave Marshes, Bedfordshire, contained more organic matter in solution than the water in the River Lea at Ponder's End after travelling about 35 miles; and also that the water of the Chadwell Spring (which is the source of the New River) contained considerably more organic matter in solution than that of the River Lea at the point where the New River Company draw their supply, and more than the water from the source of the Lea.

In the third table were given the results obtained with some of the London Water Companies' water as supplied to the public during six consecutive months—from March to August last. The samples, which were all drawn direct from the mains, were taken at the following places: East London water, at the author's laboratory, 117, High Street, Poplar; New River water, at a hydrant in Gower Street; West Middlesex water, at the Portland Road cab-rank; and the Kent water, at the Police Station, Blackheath Road. High figures were obtained from the Kent Company's water; and this, the author said, was very remarkable, as the organic carbon results published monthly by Dr. Frankland were always much lower from this Company's water than any of the others. With this exception, the results classified the four waters very much as they had been hitherto by the ordinary processes of analysis—that was to say the New River and East London were similar in quality, the former occasionally the better, while the West Middlesex was (except in July) always the worst. On the other hand, the Kent, instead of containing much less organic matter than the others, contained more than the East London and New River in June, and in July more than either of the others.

Proceeding Mr. Young said that occasionally the monthly report of Messrs. Crookes, Odling, and Tidy, on the water supplied by the London Water Companies, included an estimate of the organic matter present, which appeared to be obtained by multiplying the organic carbon found by 2·5. For the purpose of comparison, he took the organic carbon given by Dr. Frankland in his official reports to the Local Government Board, multiplied it by 2·5, and placed the results by the side of the fixed organic matter obtained by his process in some of the London Companies' water (before referred to) for the corresponding months; and it was found that, although the figures in a few cases agreed fairly well, in every instance the "fixed organic matter" was higher—the greatest difference being in the Kent water results.

The experiments recorded in the paper indicated that the volatile organic matter in water possessed somewhat of an acid nature; and in order to ascertain whether or not the presence of sulphurous acid during the evaporation caused any loss of organic matter, the author distilled a litre of East London water, to which 20 c.c. of a saturated solution of sulphur dioxide had been added, in a glass retort. When the water was reduced to about 25 c.c., it was transferred to a platinum basin, and evaporated to dryness on a water-bath, taken up in a little water and filtered through an asbestos plug into a platinum dish. Half a gramme of sodium carbonate was then dissolved in the water, the process continued, and the loss on ignition ascertained as in the ordinary method. In this way three experiments gave 0·28, 0·28, and 0·42 grain per gallon respectively, against 0·315, 0·322, and 0·469 grain, obtained by evaporating without acid. It therefore appeared, remarked the author, that the presence of sulphurous acid during evaporation caused a slight loss of the non-volatile organic matter. By repeated distillation with sodium carbonate, further traces of volatile organic matter were obtained, until, after the third or fourth repeat, the distillate contained no more. The quantity obtained in the process described represented, in ordinary drinking waters, about two-thirds of the total quantity present. By largely increasing the quantity of sodium carbonate, less organic matter was contained in the distillate; but distilled water absolutely free from organic matter on the first distillation, could only be procured by frequently agitating the water with 1 per cent. of calcium or barium hydrate, and distilling after complete subsidence and separation of the precipitate.

An attempt was made by the author to substitute barium hydrate for sodium carbonate in the process; so that nothing should be present in the residue but the alkaline salts and organic matter contained in the water under examination. The method failed; but the results obtained were very interesting. Two experiments gave 0·175 and 0·119 grain of organic matter per gallon, against 0·735 grain with sodium carbonate. The distillates were treated with 0·5 gramme sodium carbonate, and gave only 0·035 grain of organic matter per gallon in each case. These results indicated very clearly that the organic matter present had formed an insoluble compound with the baryta, and was separated in the precipitate.

In bringing his paper to a close, Mr. Young said that the process gave only the quantity of organic matter; and, although it did not afford any direct evidence of the quality of the organic matter in water, still, when there was a large quantity present, the odour given on heating enabled a fair opinion to be formed as to whether it was of animal or vegetable origin. Where only small quantities were present, he found it quite impossible to decide as to its origin by the odour given on heating the residue.

At the conclusion of the paper, there was a brief discussion, in which Mr. David Howard, one of the Past-Presidents of the Section, Dr. Thomas Stevenson, of Guy's Hospital, Dr. Thorpe, and Major Lamorock Flower, Engineer of the Lea Conservancy Board, took part.

The Birmingham Water Supply Scheme.—The Radnor County Council last Saturday week resolved, on the motion of Lord Ormathwaite, to appoint a Committee for the purpose of watching and protecting the interest of the county in connection with the proposed water scheme of the Birmingham Corporation; and the Committee were authorized to take such steps as may be necessary for this purpose, with power to join any other county or authority affected by the scheme, either to oppose or amend it in such way as may seem advisable.

NOTES FROM SCOTLAND.

From our Edinburgh Correspondent.

EDINBURGH, *Saturday.*

In this transition period, when the old authorities have laid down their powers and the new have scarcely had time to take their places, there is little of what is properly termed business to speak of. In Perth, the Gas Commission met on Monday, when the process of education was begun upon the new members. If it were not for the great responsibility which lies upon a person who essays to manage a large undertaking like a corporation gas-works, there would often be a touch of humour in the attempts whioh are made by members to walk as if learned in all the mysteries of officialdom. What else, for instance, than a smile can the remark be met with which was made at the Perth Gas Commission, that surely there must be something wrong when the Gas Manager reported the gas to be of 28-candle power, while the City Analyst reported it to be only 25·6 candles. That is bad enough; but whether it should be laughter or tears that one should indulge in when he hears another member remark that "the gas is a disgrace, and no mistake. I can hardly see to read a chapter in my Bible at night with it." I feel that whatever it should be, it should not be laughter. Yet that is what followed the utterance of this silly remark. I have before treated of the same spirit of levity and thoughtlessness which frequently crops up in corporation gas management—not in Perth alone, but in other places. Such exhibitions make me angry. They are not seemly, and they are not profitable. If an outsider makes a complaint as to the quality of the gas, it should be respectfully received and carefully considered. If any gentleman inside the controlling body fancies he has cause of complaint, he ought to be sure of his ground before he makes it public; and should he make it public, he ought to do it seriously. I preach, as I have always preached, that the management of a gas undertaking requires all the intellect which the Board can bring to bear upon it. There is no room for flippancy; still less is it desirable that the public should be led to think that those who manage the undertaking do not believe that it is honestly conducted. Such tactics would not be attempted at the board of directors of a company; and it seems as if the corporation management of gas-works is in that respect a long way behind company management. That there is a looseness somewhere is evident when it is observed that corporations, with all the advantages of guarantee rates and compulsory powers, cannot produce better results than companies do. There may be many reasons for this; but I am convinced that one of the chief is that of which I complain in this note.

It is announced that from the 16th of May to the 16th of October, the consumption of gas in Edinburgh and Leith was 339,547,000 cubic feet, a decrease of 2,859,000 cubic feet as compared with the consumption in the same period last year. This decrease is easily explained. There is no exhibition in Edinburgh this year; and there has been a rise of 9d. per 1000 cubic feet in the price of gas. When these two conditions are considered, the only marvel is that the decrease has not been greater. On account, doubtless, of the increase in the price of gas, the collection of gas-rental has been £10,121 more this year than it was at the same time last year.

However this matter of consumption may be in Edinburgh, it looks as if in Dundee there must be a large decrease at the end of the current year, owing to the introduction of electric light into public works. It is not yet a fortnight since a large firm of saw millers started an installation; and this week it is announced that two large spinning works have done the same. The local newspapers make a great flourish over the concern, and give long descriptions—manifestly prepared for them—of most elaborate arrangements for day and night lighting. The cost of the installations is not given, which is significant. What the feelings of the local authority under the Electric Lighting Provisional Order may be, in seeing the best of their future district taken up before they are ready to occupy it, it is not difficult to imagine. What is strangest about the business is that electricians, who found it so very difficult to move so long as the corporations had no statutory power to introduce electric lighting, seem to find it the easiest thing in the world to rush up installations which forestall them just as they are about to carry their new powers into effect. Is this the new form which electric light speculation is to take? It cannot be that these mill-owners are introducing electric light because of its cheapness; that is not claimed. Neither can it be on account of the better lighting, unless it be granted that mill-owners do not understand what they are doing. In such matters one ounce of practice is worth any number of pounds of theory; and I am able to apply a practical test—that of the workpeople. Last summer I spent some time at Peebles, where there is one mill lighted by electricity and the other two by gas. The workers told me that they would not take work in the electrically-lighted mills if they could get it in the others. The gas was steady, they said; but the electric light "bobbed" so much that it was sore upon their eyes, and in some of the departments it was impossible to work with it altogether—work that was required to be done having to be left over till daylight. There is probably another motive than working profit in the introduction of electric light in such places as Dundee, and the expectation of being bought up by the Corporation may explain it.

An accident—which is reported as an explosion, but of what nature is not said—occurred in the gas-works at Kinghorn to-day. The works are small and old, and I expect not in the best of order. A company was recently formed to take them over; and this disaster, which is said to have damaged the plant considerably, will fall heavily upon them. The Manager and a man were in the works—presumably the retort-house—at the time; and when the occurrence took place, the Manager is said to have escaped by the window, while the other man was left inside and was severely burned. Particulars as to the nature of the accident have not yet, however, come to hand.

From our Glasgow Correspondent.

GLASGOW, *Saturday.*

The Motherwell Gas Company's new holder was "inaugurated" on Thursday afternoon; the ceremony of turning on the gas being performed by ex-Provost Russell, the Chairman of the Board of Directors. His colleagues in the directorate were present on the occasion, as also a large number of other persons, including Mr. Fullarton, the Gas Manager, Mr. F. Leckie, Secretary to the Gas Company, Mr. J. Reid, Surveyor, and representatives of the contractors, Messrs. H. Balfour and Co., of Leven. After the ceremony was concluded, the assembled company were photographed, and then they adjourned to the Board-room, where the day's proceedings were concluded in the usual way. Mr. Russell, as Chairman, gave a detailed sketch of the progress of the gas-supply industry of the town since the completion of the first holder in the year 1849. The holder which has just been erected, at a total cost of about £5700, is the fourth. Its capacity is 205,000 cubic feet. Since the Gas Company came into existence, the burgh has thrived in an amazing manner; having become one of the most important colliery centres in Scotland, as also a prominent seat of the iron, steel, ironfounding, and engineering industries. For several years at first, however, there was no dividend for the shareholders of the Gas Company, whereas now 10 per cent. is annually divided. The price of gas in Motherwell in 1852 was 8s. 6d. per 1000 cubic feet; and in 1869, when there were 428 consumers and 69 public lamps in the burgh, the price was 5s. per 1000 feet. There are now on the Company's books the names of some 2500 consumers, and 260 lamps in the burgh are supplied with gas; the annual make being nearly 30 million feet, and the price only 3s. 9d. per 1000 feet. The promoters of the Gas Company of 1849 were represented by Mr. Andrew Reid, the only survivor of that body. As might be expected, he was able to mention to his friends who were present many interesting reminiscences of the early years of the Company. With reference to the item of cost already mentioned, it ought to be stated that it includes the contract for the excavation and building of the tank, which was executed by Mr. C. M. Hamilton.

The past week has also seen the completion of another gasholder, one for the Bridge-of-Weir Gas Company. This place is a short distance from Kilmalcolm, on the Greenock branch of the Glasgow and South-Western Railway, and like it is much taken advantage of as a sort of residential suburb for well-to-do people of business in Glasgow, Paisley, and Greenock. During the last few years it has extended so much that the gas supply was found to be wholly inadequate to the demand. That will now, however, be fully met.

In connection with this extension of the gas-works at Bridge-of-Weir (formerly a very old-fashioned country village), it is interesting to note that within some eight or nine days no fewer than three new gasholders have been brought into use within one comparatively small county—namely, that of Renfrew—one each at the Johnstone, Greenock, and Bridge-of-Weir Gas-Works; and I expect before very long another one will be ready for "inauguration." Then there is also the new holder at Motherwell, which I have just spoken of; and very shortly one of large size will be brought into active use at Uddingston, which is only a very few miles from the town last named. It will thus be seen that gas companies and gas trusts in this part of Scotland are no longer alarmed by the "bogey" man who was prognosticating, a few years ago, that the consumption of gas would soon be a thing of the past, and that electricity would provide the light of the future.

For the minerals lying under the site of the new holder which the Glasgow Corporation Gas Commissioners are intending to have erected on the Temple Farm Gas-Works, Maryhill, a sum of £1817 has been paid. That sum, however, includes the legal expenses connected with the purchase.

This week's Glasgow pig-iron market has been quiet, with very little speculative business doing. General business remains unchanged. Scotch iron has varied in price between 47s. 3d. and 47s. 7½d. per ton buyers yesterday; and there have also been fluctuations in the price of Cleveland of 2½d., and in hematite iron of 7½d.

The Scotch coal trade continues steady, and a good business is being done at previous prices. In the shipping department, there is a little irregularity, on account of the want of tonnage for certain places—the Mediterranean especially. There are a fair number of orders in the market; but boats are so scarce that there is no getting them worked off. Dross is in rather better request, and the same applies to the higher classes of house coal; but the poorer qualities in each section are moving off slowly. The following are the quotations: Main, 8s.; ell, 9s. to 9s. 3d.; splint, 9s. to 9s. 3d.; and steam, 10s. 6d. to 10s. 9d.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Nov. 14.*

Sulphate of Ammonia.—The weak state of the market continues; but a somewhat steadier tone has been perceptible during the last two or three days, and there appear to be now buyers at the lowest point touched. It is becoming evident that requirements have yet to be filled this month, both on the part of dealers and consumers; and it will depend upon the extent of these requirements whether or not prices will advance. Seeing the improved position of nitrate, and the higher prices paid for spring delivery, sulphate should, in the ordinary course of things, follow suit. This really is the case as regards delivery next year; and it must, therefore, be looked upon as unreasonable that sulphate for present delivery should remain at such a low price. Closing quotations are £10 7s. 6d. to £10 8s. 9d. at the various ports.

LONDON, *Nov. 14.*

Tar Products.—With the exception of pitch, which is still in excellent demand at the price quoted below, this market is distinctly flat and continues lifeless. The little spurt in benzols noted last week has apparently died out. Anthracene is being offered freely without finding buyers—this remark applies more particularly to "B" qualities. Manufacturers of this quality will have to take steps to improve it, or they may find themselves without a market for it at all. Makers are pretty busy in implementing old contracts. But new business for the coming year seems to be difficult to obtain; and the prices, which will have to be accepted from present buyers, will be much less than those obtaining during the past year. The following prices represent business done during the week: Tar, 20s. to 23s. 6d. Pitch, 34s. Benzol, 90's, 3s. 2½d.; 50's, 2s. 3d. Toluol, 1s. 5d. Solvent naphtha,

1s. 4½d. Crude naphtha, 1s. 1½d. Creosote, 1⅞d. Carbolic crystals 5d.; crude, 60's, 1s. 2d. Cresol, 8d. Anthracene (nominal), "A' quality, 1s. 2d.; "B" quality, 10d.

Sulphate of Ammonia.—It is difficult to understand the position of this article. It is reported that makers are remarkably free from stocks, and large shipments are going on. Notwithstanding this, the price of the article continues low, with a tendency to go lower; and manufacturers seem to lend themselves to the machinations of speculative dealers. Parcels have changed hands as low as £10 5s.; and for forward business, possibly 7s. 6d. more can be obtained—both less 3½ per cent. Gas liquor is quoted at 4s. to 5s.

THE LANCASHIRE GAS COAL TRADE.

From Our Own Correspondent.

Although for house fire qualities there is a continued fairly active demand, with prices generally firm at late rates, the coal trade of this district, taking it all through, is rather wanting in animation; and the lower descriptions, suitable for iron making, steam, and general manufacturing purposes, hang upon the market. Inferior sorts are still pushed for sale at extremely low figures; and prices all through are weak and irregular. For house-fire coals, pit prices remain at about 12s. 6d. to 13s. for best Wigan Arley; 10s. 6d. to 11s. for 4-feet and second qualities of Arley, and 9s. to 9s. 6d. for common house-fire coal. In the lower qualities of round coal, suitable for steam and forge purposes, there are plentiful supplies, not only from local collieries but from outside districts—Yorkshire especially—with the result that there is a keen competition for any business offering, and this necessarily tends to weaken prices. At the pit's mouth, good ordinary qualities of steam and forge coal are quoted at 8s. to 8s. 6d. per ton upon inland sales; but under these figures is being taken in many instances. For shipment the demand has been moderately active; and good steam coal for bunker purposes is fetching 9s. 9d. to 10s. per ton delivered at the ports on the Mersey. With regard to engine classes of fuel, there has perhaps been rather more inquiry; but as the supplies are still ample, and the common sorts continue a drug, no improvement in prices can be recorded. The chief feature to notice is that during the week inquiries have come upon the market from the Salt Union and Lime Syndicate for slack contracts for next year; and judging from the present disorganized condition of the market, and the extremely low figures at which the Chemical Union were able to secure supplies, the Salt Union, I understand, anticipate being able to obtain contracts at something like 4s. to 4s. 6d. per ton delivered at the works, which represent about the prices paid by the Chemical Union. At the pit's mouth, ordinary descriptions of burgy average 5s. 9d. to 6s. 3d.; best slack, 5s. up to 5s. 6d. for some special sorts; good ordinary qualities, 4s. to 4s. 6d.; with common sorts obtainable in special lots at from 2s. 6d. and 3s. per ton upwards.

Northern Coal Trade.—The Northern coal trade is weaker, especially in the steam coal branch. The rise in the rate of freights has caused shippers to hold back their orders as much as possible, and weather has detained vessels; so that the shipments have been limited, and the working of the collieries has been more irregular. The price of best Northumbrian steam coal has been about 10s. 3d. per ton free on board; but it is known that there have been sales at as low as 10s. per ton, which is 2s. 6d. per ton less than the rate of a few months ago. For small steam coal, the production being less, there is more stiffness in the price; about 4s. 3d. to 4s. 6d. being now the general quotation. Gas coal is in large demand, though the price varies more; it being now from 9s. to 10s. per ton free on board. There is not a large amount of the best gas coal, after the contracts that have been entered into are met; and if there were a foggy week or two, the demand would be enlarged to an extent that might influence prices considerably. But in the meantime, the demand is fairly good for the season. For bunker coal, the needs are rather limited, shipping being somewhat scarce; and the price is consequently very dull. Manufacturing coal is steady. There is very little business in household coal, in consequence of the finer weather. Blast-furnace coke is in better demand; and best Durham qualities command about 11s. to 12s. per ton at the ovens. There are now negotiations in progress for the gas coke supplies for next year; but nothing has been done as yet.

Accident to a Gasholder.—During the severe gale which passed over the country last Wednesday, the gasholder from which the Woking Station of the South-Western Railway Company is supplied was blown over, and the rollers broken. All the gas escaped; and the entire station was at night plunged into semi-darkness—the only light obtainable being from carriage-lamps. The signal-lamps, which are usually supplied with gas, had to be provided with oil-burners.

The Suicide of the Late Contractor for the Mersey Tunnel.—The London correspondent of the *Manchester Courier* says: "I hear for the first time, upon unquestionable authority, that the late Mr. Cochrane, who committed suicide at his offices in Westminster a few weeks ago, was driven to the act immediately after receipt of a lawyer's letter from the Liverpool Corporation concerning the contract which he had undertaken for constructing the Vyrnwy tunnel under the Mersey. The Corporation had imposed in this matter conditions of work against which Mr. Cochrane had protested, on the ground that they were impracticable and all but impossible; and, as was admitted at the meeting of the Liverpool Town Council the other day, he had lost about £17,000 over the contract. Just before Mr. Cochrane received the lawyer's letter above mentioned, the Corporation consulted Sir Benjamin Baker with regard to the tunnelling; and in consequence of opinions expressed by that eminent Engineer, they decided to modify the conditions which they had imposed upon Mr. Cochrane. Unfortunately this decision was not promptly communicated to Mr. Cochrane; otherwise I am assured he would have been still alive. Sir B. Baker was greatly distressed to hear of Mr. Cochrane's death; and the more so because he could, had he seen him a little while before, have given him news which must have prevented it."

Linton Water-Works Company, Limited.—This Company has been registered with a capital of £1000, in £10 shares, to supply the village and township of Linton, in the West Riding of Yorkshire, and the immediately adjacent places, with water, and to carry on generally the business of a water company.

The Wakefield Water and Lead-Poisoning.—An inquiry was held at Wakefield, on the 2nd inst., by the District Coroner (Mr. Maitland), relative to another supposed death from lead-poisoning, said to be produced by the use of water supplied by the Corporation of Wakefield. The deceased was a married woman, named Sarah Ann Hall (aged 42 years); and the certificate of death alleged plumbism as the cause. Two medical gentlemen were examined. One of them (Dr. Heathcote) stated that he had come to the conclusion that the woman died of lead-poisoning, accelerated by the pressure of a cyst in the liver upon the lower lobe of the right lung; while the other (Dr. Wade) was of opinion that death had resulted from the pressure of the cyst upon the heart, and the impediment thus caused to the circulation of the blood. The Coroner thought the case was of great importance, and adjourned the inquiry until the following Friday in order to obtain further evidence. On that day Dr. Statter, the medical attendant of the deceased, bore out Dr. Heathcote's statement that Mrs. Hall died of lead-poisoning. He added that he had now 90 cases of lead-poisoning in the city and district. Dr. Roulston, who was called in to express an opinion on the medical evidence, had no doubt the woman died from lead-poisoning. The jury returned a verdict "that the deceased woman, being unhealthy, died from lead-poisoning, the cause of which was unknown." The inquest on the body of Mary Elizabeth Keighley, who, it was alleged, had also died from lead-poisoning, caused by the use of Wakefield water, was resumed last Tuesday (see *ante*, p. 809). The Coroner (Mr. J. C. Malcolm) announced, at the opening of the proceedings, that the Local Government Board had written to say that they deemed it inadvisable that they should intervene in connection with the case; but at the same time, they fully realized the importance of the general question of the lead-dissolving power of the moorland water in certain districts, and an investigation on their behalf was being proceeded with. No further evidence was called; but, after a little discussion, the jury returned a verdict of "Death from lead-poisoning."

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 800.)

Issue.	Share	When ex-Dividend.	Dividend or Div. on Bonus.	NAME	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	15 Oct.	10½	Alliance & Dublin 10 p. c.	10	16—17	..	6 3 6
100,000	10	"	7½	Do. 7 p. c	10	11½—12½	..	6 0 0
300,000	100	1 July	5	Australian (Sydney) 5 % Deb.	100	106—108	..	4 12 7
100,000	20	28 May	8	Bahia, Limited	20	13—15	..	10 13 4
200,000	5	12 Nov.	7½	Bombay, Limited	5	6½—6¾*	..	5 11 1
40,000	5	"	7½	Do. New	4	4½—5¼*	+⅛	5 14 1
380,000	Stck.	13 Aug.	12½	Brentford Consolidated	100	210—220	−5	5 11 4
125,000	"	"	9½	Do. New	100	157—162	..	5 14 2
220,000	20	16 Sept	11½	Brighton & Hove Original	20	40—42	..	5 9 6
444,250	Stck.	16 Sept.	10	Bristol	100	206—211	..	4 14 6
320,000	20	15 Oct.	11½	British	20	42—44	−2	5 2 3
50,000	10	28 Aug.	11½	Bromley, Ordinary 10 p. c.	10	18—20	..	5 15 0
50,380	10	"	8½	Do. 7 p. c.	10	13—15	..	5 13 4
328,750	10	13 Nov.	6	Buenos Ayres (New) Limited	10	6—7	−⅛	—
200,000	100	1 July	6	Do. 6 p. c. Deb.	100	92—96	..	6 5 0
150,000	20	13 Aug.	8	Cagliari, Limited	20	24—26	..	6 3 1
550,000	Stck.	15 Oct.	13¾	Commercial, Old Stock	100	240—250	..	5 10 0
161,396	"	"	10¾	Do. New do.	100	185—195	..	5 10 3
130,000	"	26 June	4½	Do. 4½ p. c. Deb. do.	100	119—124	..	3 12 7
800,000	Stck.	11 June	10	Continental Union, Limited	100	215—225	..	4 8 10
200,000	"	"	7	Do. 7 p. c. Pref	100	190—200	..	3 10 0
75,000	Stck.	16 Sept.	10	Crystal Palace District	100	190—200	..	5 0 0
486,090	10	15 July	10	European, Limited	10	19—20	..	5 0 0
354,060	10	"	10	Do. Partly paid	7½	14—15	..	5 0 0
5,470,640	Stck.	13 Aug.	13	Gaslight & Coke, A, Ordinary	100	215—220	..	5 18 2
100,000	"	"	4	Do. B, 4 p. c. max.	100	93—96	−1	4 3 4
665,000	"	"	10	Do. C, D, & E, 10 p.c. Pf.	100	250—255	−1	3 18 5
30,000	"	"	5	Do. F, 5 p. c. Prf.	100	118—123	..	4 1 4
60,000	"	"	7½	Do. G, 7½ p. c. do.	100	172—177	..	4 4 9
1,300,000	"	"	7	Do. H, 7 p. c. max	100	155—160	..	4 7 6
463,000	"	"	10	Do. J, 10 p. c. Prf.	100	249—254	−1	3 18 9
476,000	"	"	—	Do. K, 6 p. c. Prf.	100	145—155	..	3 17 5
1,061,150	"	11 June	4	Do. 4 p. c. Deb. Stk.	100	112—115	..	3 9 7
294,850	"	"	4½	Do. 4½ p. c. do.	100	120—125	..	3 12 4
908,000	"	"	6	Do. 6 p. c. do	100	163—168	..	3 11 5
3,800,000	Stck.	12 Nov.	12	Imperial Continental	100	213-218*	+1	5 10 1
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	4¼—4¾	..	6 6 4
560,000	100	1 Oct.	5	Met. of Melbourne, 5 p. c. Deb.	100	109—111	..	4 10 1
541,920	20	11 June	6¾	Monte Video, Limited	20	16—17	..	7 12 11
150,000	5	28 May	10	Oriental, Limited	5	8¼—8¾	..	5 14 3
60,000	5	30 Sept.	7	Ottoman, Limited	5	4—5	..	7 0 0
166,870	10	26 Feb.	2	Pará Limited	10	2¾—3¼	..	—
				People's Gas of Chicago—				
420,000	100	3 Nov.	6	1st Mtg. Bds.	100	90—95	..	6 6 4
500,000	100	1 June	16	2nd Do.	100	90—95	..	6 6 4
150,000	10	15 Oct.	10	San Paulo, Limited	10	12¾—13¼	..	7 8 1
500,000	Stck.	28 Aug.	15½	South Metropolitan, A Stock	100	260—270	..	5 14 10
1,350,000	"	"	12	Do. B do.	100	220—225	..	5 6 8
200,000	"	"	13	Do. C do.	100	225—235	..	5 10 8
700,000	"	26 June	5	Do. 5 p. c. Deb. Stk.	100	140—145	..	3 9 0
600,000	Stck.	16 Sept.	11½	Tottenham & Edm'nton, Orig.	100	—	..	—
				WATER COMPANIES.				
729,281	Stck.	26 June	10	Chelsea, Ordinary	100	263—268	−2	3 14 8
1,720,560	Stck.	15 Oct.	8	East London, Ordinary	100	204—209	..	3 16 7
544,440	"	26 June	4½	Do. 4½ p. c. Deb. Stk.	100	138—143	..	3 3 0
700,000	50	11 June	8	Grand Junction	50	105—110	..	3 12 9
708,000	Stck.	13 Aug	10½	Kent	100	260—270	..	3 17 9
1,043,800	100	26 June	9½	Lambeth, 10 p. c. max.	100	233—238	−2	3 19 10
406,200	100	"	7½	Do. 7½ p. c. max.	100	195—200	..	3 15 0
260,000	Stck.	30 Sept.	4	Do. 4 p. c. Deb. Stk.	100	118—121	..	3 6 1
500,000	100	13 Aug.	12½	New River, New Shares	100	335—345	−3½	3 10 4
1,000,000	Stck.	30 July	4	Do. 4 p. c. Deb. Stk	100	123—126	..	3 3 6
902,300	Stck.	11 June	6½	S'thwk & V'xhall, 10 p. c. max.	100	160—165	..	3 18 9
126,500	100	"	6½	Do. 7½ p. c. do.	100	160—165	..	3 18 9
1,755,066	Stck.	11 June	10	West Middlesex	100	250—255	−2	3 18 5

*Ex div.

Longton Corporation Gas Department.—The accounts of the Longton Corporation Gas Committee for the year ending June 30 last show a gross profit of £7183; and after deducting the payments on account of principal and interest on loans and sinking fund, there remains a balance of £2234 to the credit of the borough fund and in relief of rates. It was stated by Alderman Prince, in moving the adoption of the accounts at the last meeting of the Council, that since the borough had taken over the gas-works in 1878, £32,510 had been the extent of the profits handed over to the relief of the rates.

Electric Light for Tiverton.—The Borough Surveyor of Tiverton (Mr. J. Siddalls) recently reported to the Corporation Electric Lighting Committee upon the introduction of the light into the borough; and he recommended them to advertise for offers from persons or companies willing to undertake the powers of their Provisional Order for a specified term. In moving the adoption of this recommendation at the last meeting of the Council, Mr. Grason, the Chairman of the Committee, said personally he was in favour of the town undertaking the work. At any rate, they must make use of water power, which would mean a saving of £800 a year. To lay down an electric light plant would cost about £15,000, which they could borrow for thirty years. The interest and repayment of principal would amount to £800 per annum; and the working expenses would be another £500. These figures compared favourably with what they were paying for gas (£700 per annum), as they could reckon on receiving £700 for private lighting. He was convinced that they could work the scheme at a profit to the ratepayers. Alderman Ford seconded the motion, which was unanimously carried.

The Recent Action by Local Boards against the Oldham Corporation.—From the minutes of a Special Committee submitted at the last meeting of the Failsworth Local Board, it appeared that a communication had been received from the Clerk of the Chadderton Local Board, asking them to co-operate with the other Local Boards in consulting Counsel with a view to contesting the judgment in the recent action by the Local Boards against the Oldham Corporation (see *ante*, pp. 792, 804). The Special Committee had replied that, until they were further advised by the Board, they would not take part in the proposed consultation. After these minutes had been read, Mr. Hilton inquired whether it would cause the other Local Boards to withdraw from the matter if Failsworth decided not to go any further? The Chairman (Mr. S. Tong) said he did not think it would, because, as far as he could gather, the others were very confident that, if an appeal were made, the judgment would not be upheld. Mr. Robinson thought the Failsworth Local Board had had sufficient lessons in the past. They had been dragged into this matter by the Chadderton Local Board; and he supposed they would now have to pay for it. The Chairman remarked that, before the case was entered into Court, Counsel's advice was sought on the matter. The Special Committee was very reluctant about going on with it; but it was thought that it would not be proper, supposing the case had ended favourably to the Local Boards, for them to have expected to participate in the benefits arising out of it if they had held aloof from the action. Mr. Hilton said he should not like it to go forth that in the past money had been wasted in contesting Oldham, because he believed that, in the case to which Mr. Robinson referred, the money had been well spent, as the benefits of the action were felt all round. They had the sweeping away of the differential charge for gas, and then the Oldham Corporation were prevented from establishing objectionable works in Failsworth. On the suggestion of Mr. Dunkerby, it was decided to proceed with the discussion in private.

The Artesian Well in the City.—At the meeting of the Commissioners of Sewers of the City of London last Tuesday week, the Engineer (Mr. W. Haywood, M. Inst. C.E.) reported upon the artesian well which the Commissioners are sinking at the artizans' dwellings in the Minories. He stated that the well had been bored to an additional depth of 100 feet, making 450 feet in all; the average daily yield being 50,000 gallons. He recommended that the boring should be continued for another 100 feet. Mr. Malthouse said he did not intend that this new supply of water—which was independent of the Water Companies—should be confined to the dwellings alone. It might be the means of supplying the surrounding district, and the commencement of a new supply for the whole City; but, at all events, it would be a great factor in considering the value of the Companies' property when any purchase was in contemplation. He moved that the additional 100 feet should be bored. The Engineer said the cost would be £1 10s. per foot. Mr. Wallace suggested that there was danger in the additional boring, as the supply might suddenly cease. Mr. Sly said there might be matters of a legal and an engineering character which it would be desirable to inquire into before proceeding further; and he suggested a reference to a Committee. Mr. Bedford remarked that the Water Companies had no monopoly in the City of London, whatever might be their position outside. Mr. Malthouse said there was no fear of a cessation in the supply, as the water-bearing strata went to a great depth. The motion was carried, and it was further arranged that Dr. Sedgwick Saunders, the Medical Officer, should analyze the water, and make a report at the next meeting.

A Chinese Gas Undertaking.—According to the first annual report on the operations of the Tien-Tsin Gas Company, in the province of Pe-Chee-Lee, China, the amount invested in the undertaking is about £5000, most of which has been subscribed by foreign residents in Tien-Tsin; and the profit earned in the twelve months was about £110. At present the gas-mains extend only through the business and residential quarters of the foreign population, which is composed chiefly of English and Americans; but it is the intention of the proprietors to push on to the Chinese quarters. The total quantity of gas made was 1,540,911 cubic feet. The public lights take 893,383 cubic feet, while the consumption on private account amounted to 537,616 cubic feet. The unaccounted-for gas, therefore, was 103,912 cubic feet. The average charge is about 19s. per 1000 cubic feet. The manufacturing process in use is Dr. Hirzell's; and he guaranteed the following results: The average duration of a retort was to be 120 days, with an hourly production of 300 to 400 cubic feet of gas; 100 lbs. of refined kerosene oil were to yield 953·5 cubic feet of gas; a burner consuming 1·5 cubic feet of gas per hour was to have a minimum lighting power of 12 candles; and 380 lbs. of coal would evaporate 100 lbs. of oil. The Manager of the works (Mr. Poulsen) finds that the retorts last, on an average, 120 days; that the hourly gas production is 340 cubic feet; that 1080 cubic feet of gas are produced from 100 lbs. of oil; that burners varying from 1·54 to 2·1 cubic feet consumption per hour yield a light of from 16 to 22 candles; and that 145 lbs. of Kai-ping coal are required to "evaporate" 100 lbs. of oil. Mr. Poulsen gets from the oil 20 per cent. of creosote tar, which is sold and used for painting and preserving wood; the price obtained being 5d. per gallon. About 33 per cent. of the coal is converted into coke. The total length of mains is 6000 yards; and the work is done by Chinese labourers. Gas is made every second day, and with one retort only; and it is supplied to 154 public lamps, and about 980 private burners. In spite of difficulties caused by water and fire, the service has been continuous.

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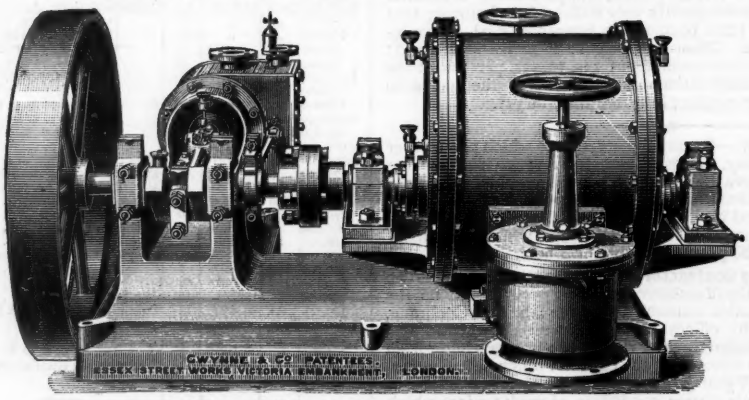

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Orders for Alterations in, or Stoppages of PERMANENT ADVERTISEMENTS should be received not later than the FIRST POST on SATURDAY.

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The whole must be removed, and the ground cleared, by March 25, 1892.

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THE SUB-COMMITTEE of the above-named Asylum offer FOR SALE a GASHOLDER, 30 feet diameter by 14 feet deep, with Five Cast-Iron Columns, Cast-Iron Girders to top of Columns, Guides, and Guide-Rollers.

The Gasholder can be inspected at the Asylum: and forms of tender, upon which only tenders will be received, can be obtained of the Steward at the Asylum.

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The Sub-Committee do not bind themselves to accept the lowest or any tender.

R. W. PARTRIDGE,
Clerk to the Asylums Committee.

London Asylums Committee Office,
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Nov. 10, 1891.

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THE Directors of the Sheffield United Gaslight Company invite TENDERS for the supply of FIRE-CLAY GOODS (Retorts, Bricks, &c.) required for Repairs at their Neepsend and Effingham Street Stations during the next Twelve months.

Specifications and forms of tender may be had on application to the Company's Engineer, Mr. Fletcher W. Stevenson.

The Directors do not bind themselves to accept the lowest or any tender.

Sealed tenders, marked "Tender for Fire-Clay Goods," must be delivered by post, addressed to the undersigned, not later than Monday, the 30th inst.

HANBURY THOMAS,
General Manager.

Commercial Street, Sheffield,
Nov. 6, 1891.

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LINTRATHEN SUPPLY.

CONTRACT No. 1.

THE Dundee Water Commissioners are prepared to receive TENDERS for 4100 tons, or thereby, of CAST-IRON PIPES and SPECIAL CASTINGS, 24 inches and 27 inches diameter.

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Sealed offers, endorsed "Tender for Contract No. 1" or "No. 2," as the case may be, to be delivered at the Subscriber's Office not later than Noon on Tuesday, the 1st of December, 1891.

The Engineer will meet intending Contractors at Auchterhouse Station on Wednesday, the 18th current, at One p.m. to show them over the line of intended Works.

The Commissioners do not bind themselves to accept the lowest or any offer.

GEORGE BAXTER, Engineer.

Dundee Water Commissioners' Engineer's Office,
7, Euclid Street, Nov. 10, 1891.

NEW ROMNEY GASLIGHT AND COKE COMPANY, LIMITED.

THE Directors of the above Company have FOR DISPOSAL the REMAINDER of the Issue of 400 SHARES—viz., 84 Shares of £5 each.

Applications for such Shares at par to be made on or before the 28th inst., to

WM. ALLEN, Secretary.

New Romney, Kent,
Nov. 14, 1891.

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MESSRS. GEORGE NICHOLS, SON, AND ALDER are instructed to offer FOR SALE by Public Auction at their Sale Room, 49, Broad Street, Bristol, on Tuesday, the 1st day of December next, at 2.30 p.m. precisely, in Lots of £100 each,

£20,000 NEW DEBENTURE STOCK,

created and issued in manner prescribed by The Bristol Gas Act, 1891.

Particulars and copies of the Conditions of Sale may be obtained on application to the undersigned; to the AUCTIONEERS, 49, Broad Street, BRISTOL; or to Messrs. BRITTAN, LIVETT, AND MILLER, Solicitors, Albion Chambers, BRISTOL.

JAMES VINCENT GREEN,
Secretary.

Chief Offices: Canon's Marsh,
Bristol, Nov. 4, 1891.

MONTE VIDEO GAS COMPANY, LIMITED.

NOTICE is hereby given, that the Books for the TRANSFER OF SHARES WILL BE CLOSED from Monday, the 16th of November, to Saturday, the 28th of November, 1891, both days inclusive, for the preparation and issue of Warrants, in payment of an Interim Dividend for the Half Year ended June 30, 1891.

By order of the Board,
A. G. HOUNSHAM,
Secretary.

Offices of the Company: Suffolk House,
Laurence Pountney Hill, Cannon Street,
London, E.C., Nov. 11, 1891.

BRIGHTON AND HOVE GENERAL GAS COMPANY.
(INCORPORATED BY ACT OF PARLIAMENT.)

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MESSRS. G. A. WILKINSON & SON (in conjunction with Messrs. Wilkinson, Son, & Welch, of Brighton), are instructed by the Directors of the Brighton and Hove General Gas Company to sell BY AUCTION, at the Mart, Tokenhouse Yard, City, E.C., on Thursday, Nov. 26, 1891, at Two o'clock precisely, 635 SEVEN PER CENT. "A" ORDINARY SHARES of £20 each in the above Company, in 125 lots, being Five Shares in each lot.

The Sale is under the provisions of the Company's Acts of 1879.

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BY

WILLIAM ARNOLD, F.S.I.,

Land and Estate Agent; Rating Surveyor and Valuer Chairman of the Tamworth Gaslight and Coke Company.

LONDON:
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JAMES OAKES & Co.,

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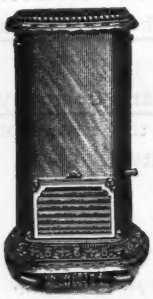

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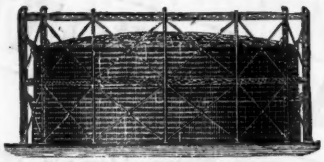

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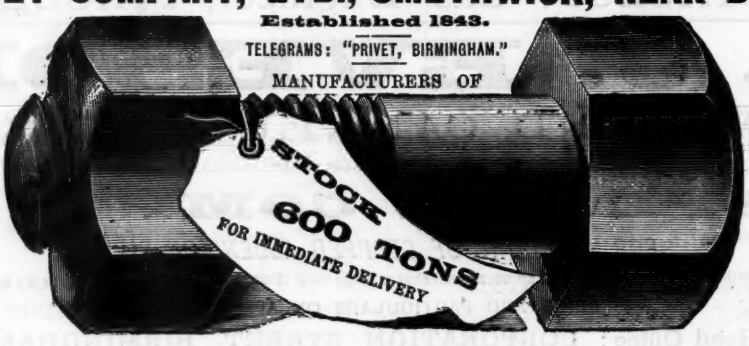

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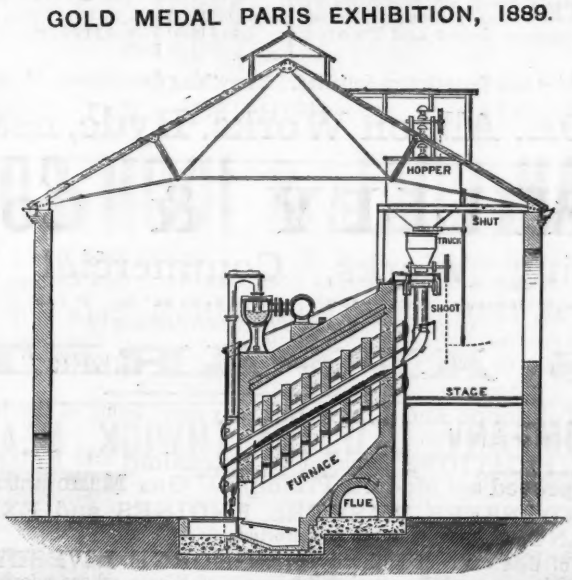

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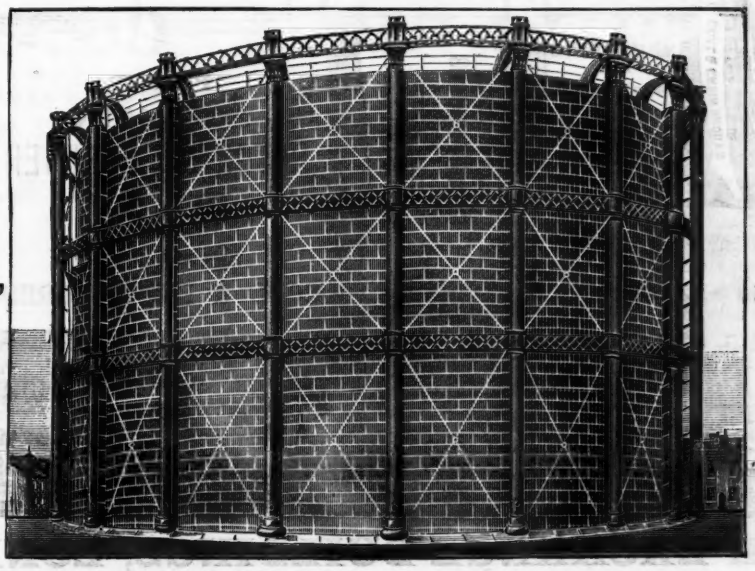

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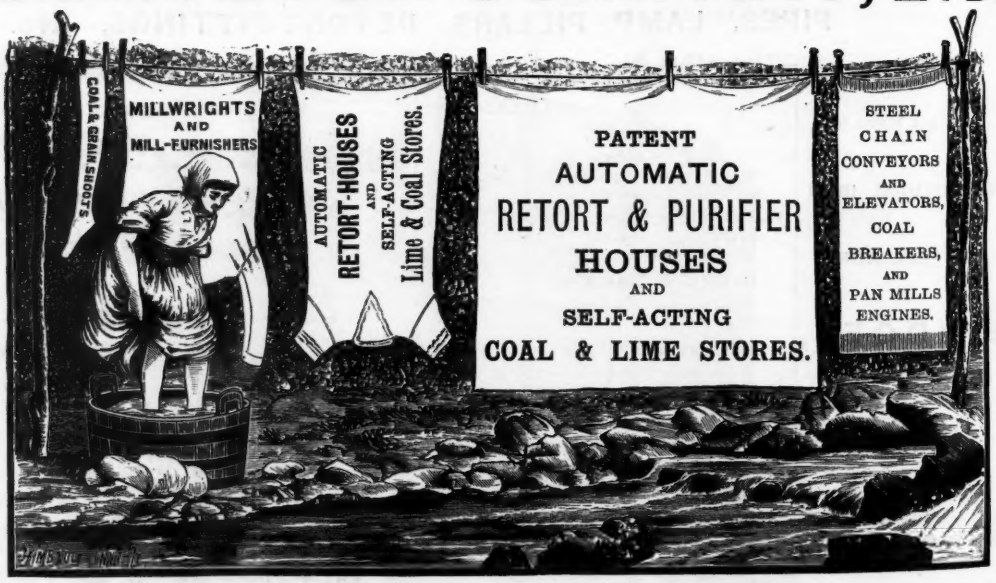
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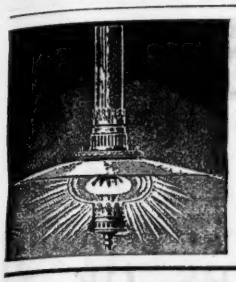

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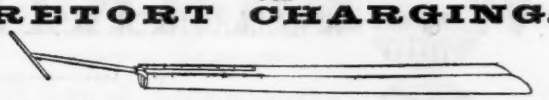

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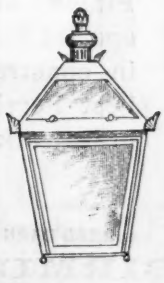

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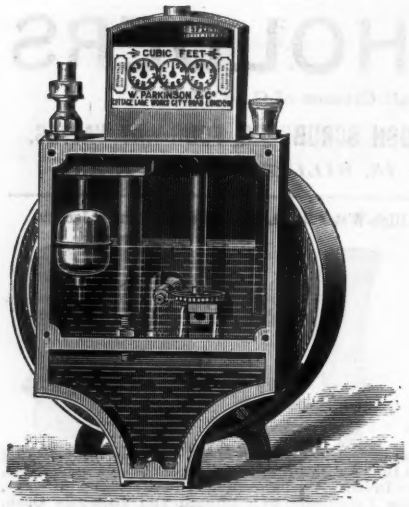

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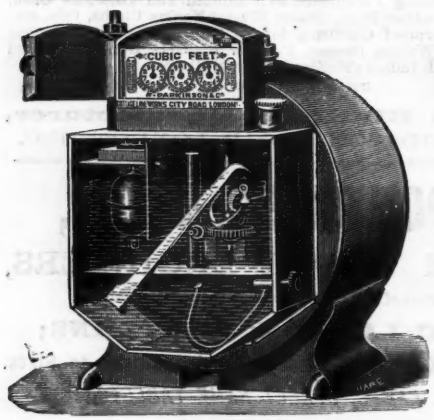

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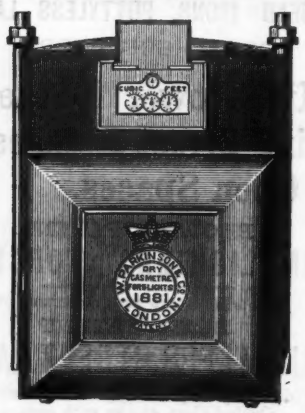

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[See also Advt., p. 886.

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